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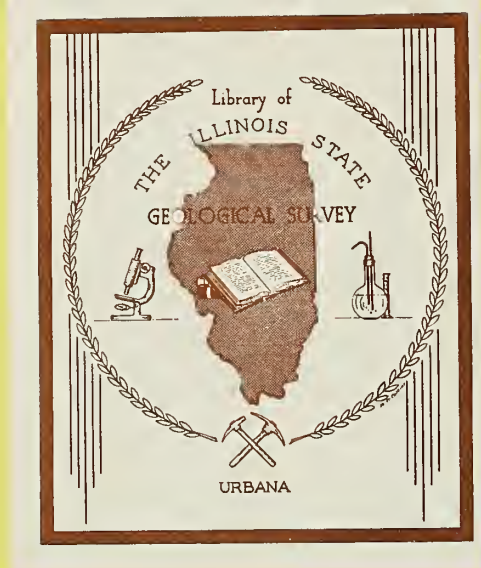
GEOLOGY OF THE KANKAKEE RIVER SYSTEM IN KANKAKEE COUNTY, ILLINOIS

David L. Gross and Richard C. Berg



Illinois Institute of Natural Resources
STATE GEOLOGICAL SURVEY DIVISION
Jack A. Simon, Chief

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COVER PHOTO: Vertical aerial photograph of the Kankakee River at the Illinois-Indiana state line.

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ABSTRACT

The Kankakee River flows westward from Indiana to Illinois. The headwaters are near South Bend, Indiana, and the mouth is the confluence with the Des Plaines River where those two rivers become the Illinois River.

In work beginning in the late nineteenth century and essentially completed by 1918, almost all of the main channel of the Kankakee River in Indiana was channelized. Today that channel is a man-made ditch, extending straight for many miles between small bends. In Indiana, all of the natural meanders were removed. In Illinois, a very small dam exists at Momence and a larger dam exists at Kankakee, but most of the river remains a naturally meandering stream.

The geologic framework of the Kankakee River as we know it today was established at the time of the melting of the last continental glaciers. That melting occurred during the approximate interval from 16,000 to 13,000 years ago, the latter portion of the Woodfordian Substage of the Wisconsin Stage. From the time of the glacial melting to the present day, the Kankakee River has carried great quantities of sand westward.

Most of the landscape adjacent to the main stem of the Kankakee River in Indiana is sand. The geology of the Illinois portion of the basin is more complex; in Kankakee County, Illinois, it includes silty and clayey glacial tills, silty and clayey lacustrine sediment, exposed bedrock, and sand.

From the Illinois-Indiana state line downstream to near the city of Momence, the river channel is underlain by thick deposits of sand overlying bedrock. In the several miles of river channel adjacent to Momence and a 2-mile reach upstream of Aroma Park, the Kankakee River is flowing over bedrock. In the area between the cities of Momence and Aroma Park, the channel contains a series of massive sand bars, up to 1 or 2 meters thick, overlying bedrock. The upper (eastern) end of Six Mile Pool contains thick sand deposits. In the lower end (western) of Six Mile Pool, near the city of Kankakee, the main channel is underlain by bedrock although the insides of the meanders have sand bars.

This report was submitted by the Illinois State Geological Survey in fulfillment of Contract 20.121 between the Illinois Institute of Natural Resources and the University of Illinois. It is one of a series of studies of the hydrology and sediment transport (Illinois State Water Survey), the biology (Illinois Natural History Survey), and the geology (this report) of the Kankakee River system in Illinois.

INTRODUCTION

THE RIVER SYSTEM

The Kankakee River flows westward from Indiana to Illinois. The headwaters are near South Bend, Indiana, and the mouth is the confluence with the Des Plaines River where those two rivers become the Illinois River. Of the 5,165 square miles in the Kankakee River drainage basin, 2,169 are in Illinois and 2,996 are in Indiana.

An index map of the basin is provided in figure 1. The change at the state line in the morphology of the river, from channelized to natural, is illustrated in figure 2. In work beginning in the late nineteenth century and essentially completed by 1918, almost all of the main channel of the Kankakee River in Indiana was channelized. Today that channel is a man-made ditch, extending straight for many miles between small bends. In Indiana, all of the natural meanders were removed. In Illinois, a very small dam exists at Momence and a larger dam exists at Kankakee, but most of the river remains a naturally meandering stream.

For most of the twentieth century there has been a substantial difference in management practices in Illinois and in Indiana. In Indiana, the river system has been constructed and managed as an agricultural drainage project—successfully draining the wetlands and converting them into very productive agricultural land. The intent of the management has been based on the economics of agricultural production. In Illinois, especially in Kankakee County, the river has been used as a scenic, cultural, and recreational resource. The reach between the state line and Momence is a naturally meandering stream with a sandy bottom, traversing an area of timber and relatively undisturbed wetlands. The reach between the cities of Momence and Aroma Park is also a natural stream, traversing an area of alternating bedrock and sandy bottom. Between Aroma Park and the city of Kankakee, a deep-water area called Six Mile Pool (actually 4.7 miles long) was formed by the construction of a dam at Kankakee. The deeper water has long been utilized for recreational boating, and fine homes have been built in the surrounding area. All of the river in Kankakee County is noted for high water quality, excellent sport fishing, and scenic beauty.

Although the management practices, which are a human action, differ significantly between the two states, there are some important geological differences that also occur near the state line. The wetlands, which are a result of continental glaciation, occur mainly on the Indiana side of the line. The areas of bedrock outcrops, where the glacial deposits are thin or absent, occur mainly on the Illinois side of the line. In a companion report, Bhowmik and others (in press) explain that these bedrock outcrops in Kankakee County have long been an important factor in the hydrology of the river.

The dam at Kankakee is of special interest. Built for the generation of hydroelectric power, it is no longer used for that purpose. Today it is owned and operated by the Illinois Department of Conservation. During times of high flow the dam has relatively little effect on the river, but during periods of low flow it retains sufficient water in Six Mile Pool to not only assure the public water supply of the city of Kankakee, but also to support the major recreation resource of boating, fishing, swimming, and scenic beauty. Recently

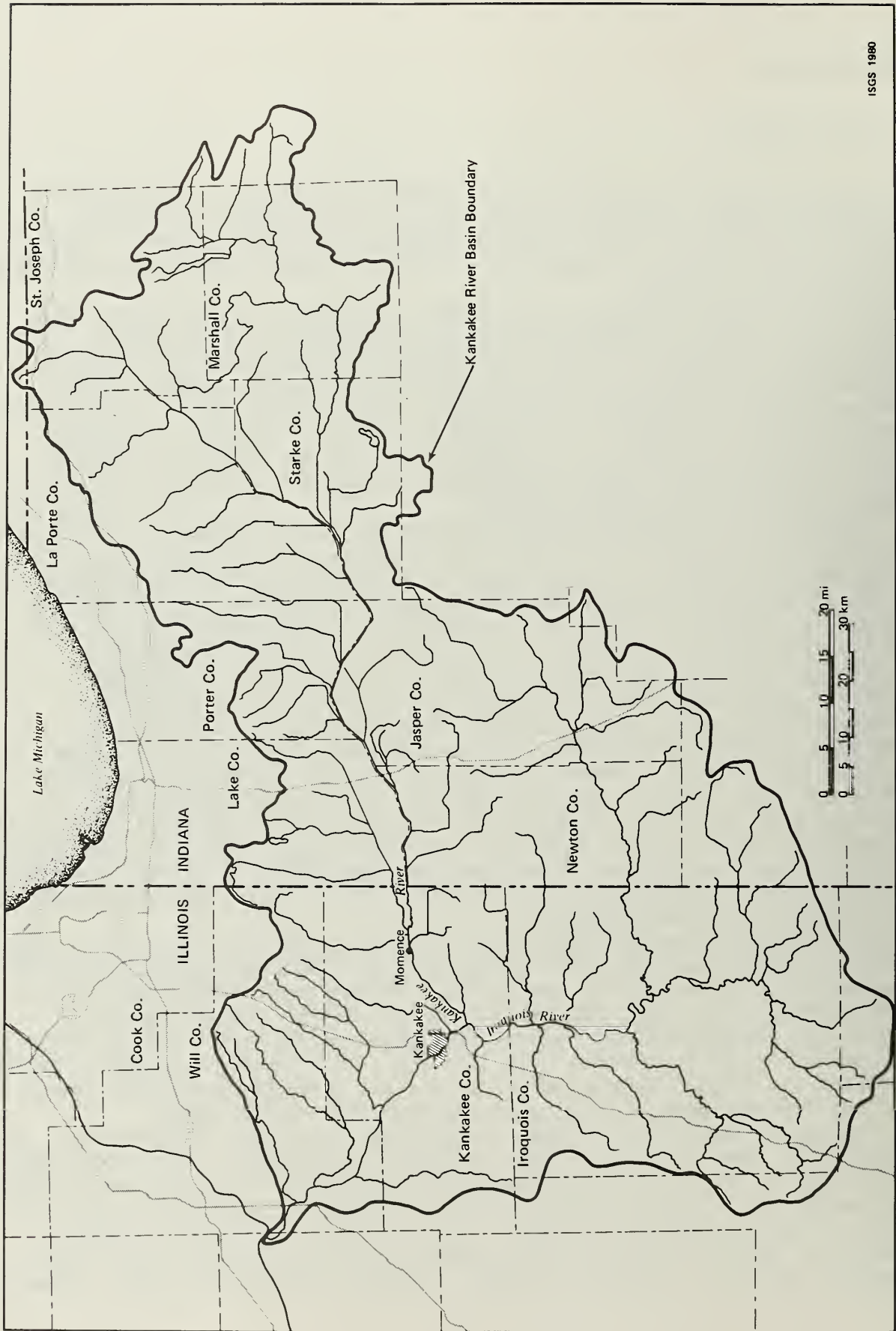


Figure 1. Index map of the Kankakee River Basin.

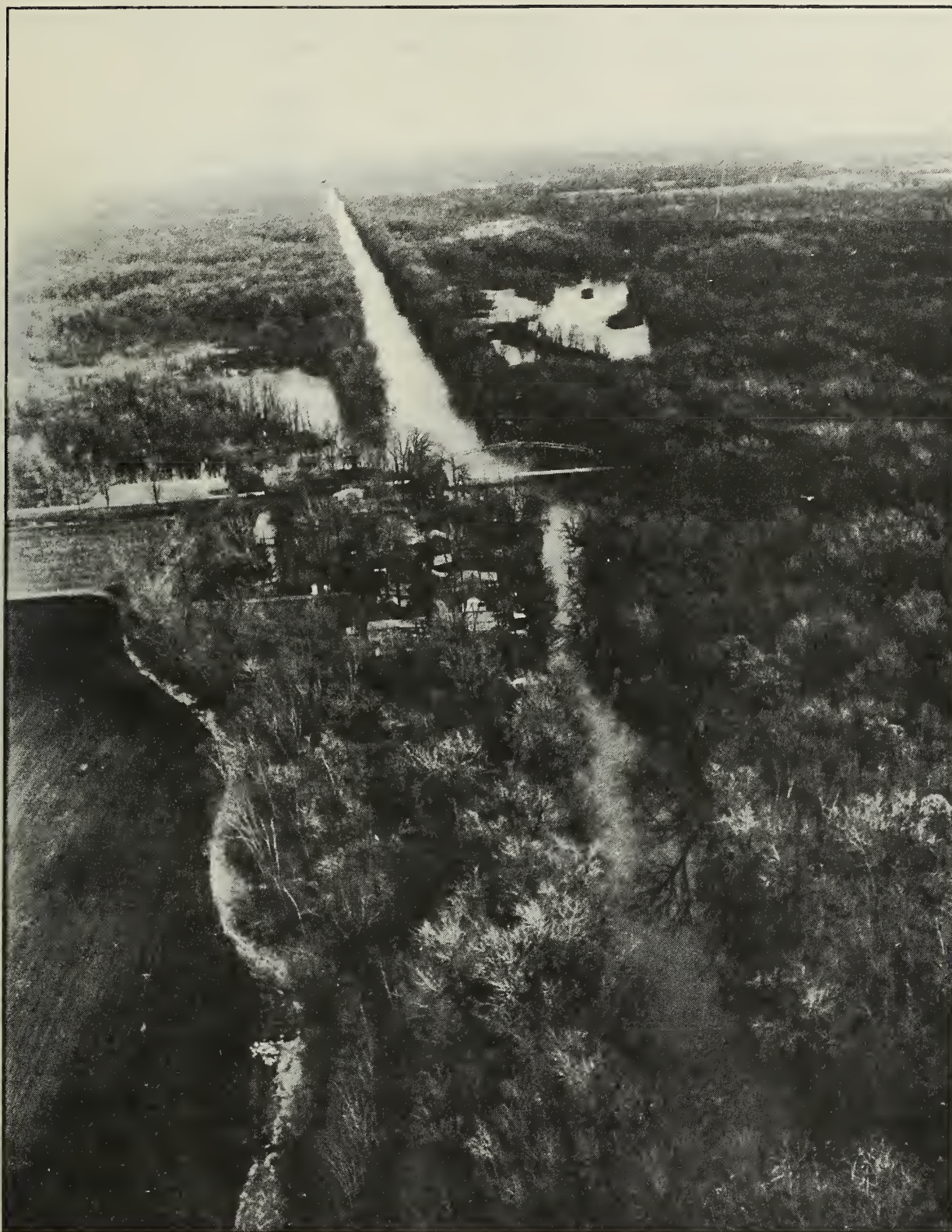


Figure 2. Photograph of the Kankakee River at the Illinois-Indiana state line. The bridge is on the state line. The channelized portion of the river in Indiana is shown in the background and the naturally meandering portion of the river in Illinois is shown in the foreground. (Chicago Tribune photo)

there has been some study of the possibilities of again using this site for the generation of hydroelectric power (Lindsey and Sweeney, 1980).

GOALS OF THIS PROJECT

A Kankakee River Basin Task Force was formed by Governor James R. Thompson in June 1977 to respond to expressions of concern by basin residents and to develop solutions for the problems of the river. A report of that task force (State of Illinois, Final Report to the Governor, 1978) contained eleven working papers summarizing the status of knowledge of the Kankakee River and a series of conclusions recommending that the State of Illinois maintain the river as a low-density recreational and scenic river. The report also commented that it "has run up against the limits of the available information about the ways of the Kankakee River" and it recommended that a series of research projects be undertaken. In 1978, the Illinois Institute of Natural Resources contracted for a series of studies of the hydrology and sediment transport (Illinois State Water Survey), the biology (Illinois Natural History Survey), and the geology (this report, Illinois State Geological Survey) of the Kankakee River system as well as economic studies of the value of the wetlands in Illinois (Mitsch, Hutchison, and Paulson, 1979).

Beginning in 1979, the management of the river system has been in litigation in a Federal Court. At issue is a proposed series of levee repairs, clearing, and snagging in the channelized portion of the river in Indiana. At the date of this writing (November 1980) these issues have not been fully resolved.

This report is a description of the bedrock and sediment in the Kankakee-Momence area of the Kankakee River. The companion study prepared by the Illinois State Water Survey is concerned with the active transport of sediment by the modern system. By examining the sediment now residing in the river in Illinois, which is one of the end results of sediment transport from the agricultural lands of Indiana, we proposed to study the changes in the rate of sediment accumulation and the changes in sediment composition that occurred as a result of the upstream channelization. This, however, proved to be a difficult problem as will be shown in the discussion.

PREVIOUS STUDIES

Although the number of documents relating to the geology of sediment in the Kankakee River is limited, they proved to be extremely useful and are the cornerstone of this report. Four published geologic maps were used to compile the map in figure 3. Schneider and Keller (1970), Wayne, Johnson, and Keller (1966), and Johnson and Keller (1972) are maps published by the Indiana Geological Survey at a scale of 1:250,000. Those three maps describe the geology of the glacial deposits in all of the Indiana portion of the drainage basin. The fourth map, Lineback (1979), was published by the Illinois State Geological Survey at a scale of 1:500,000 and describes the glacial deposits of Illinois. Unpublished maps at scales of 1:250,000 and 1:62,500 in the files of the Illinois State Geological Survey provided detailed information for the compilation shown in figure 3.

A primary source for this study was the "Final Report to the Governor" of the Illinois Kankakee River Basin Task Force (1978) and the similar report

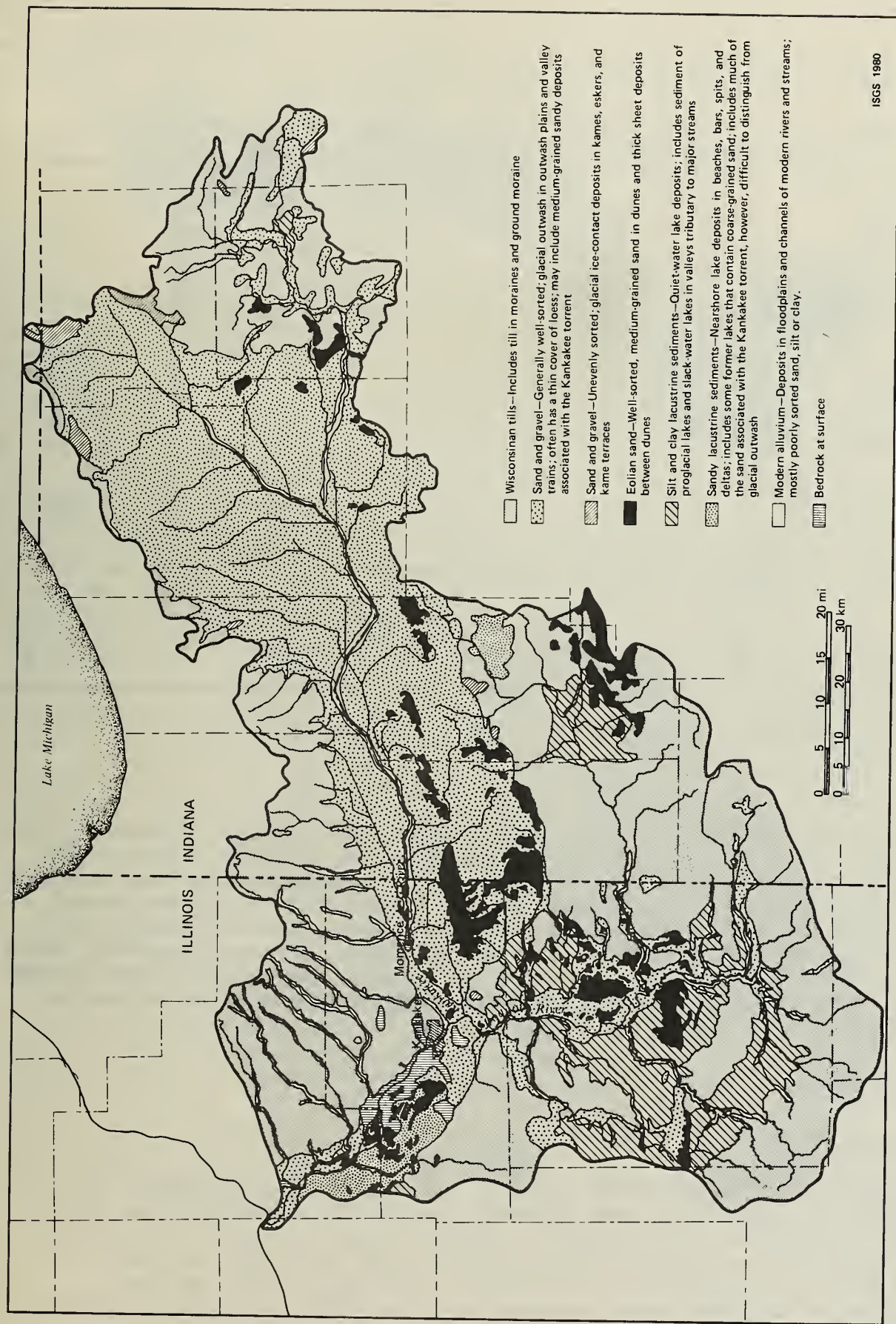


Figure 3. Map of the Kankakee River Basin showing the nature of surface materials.

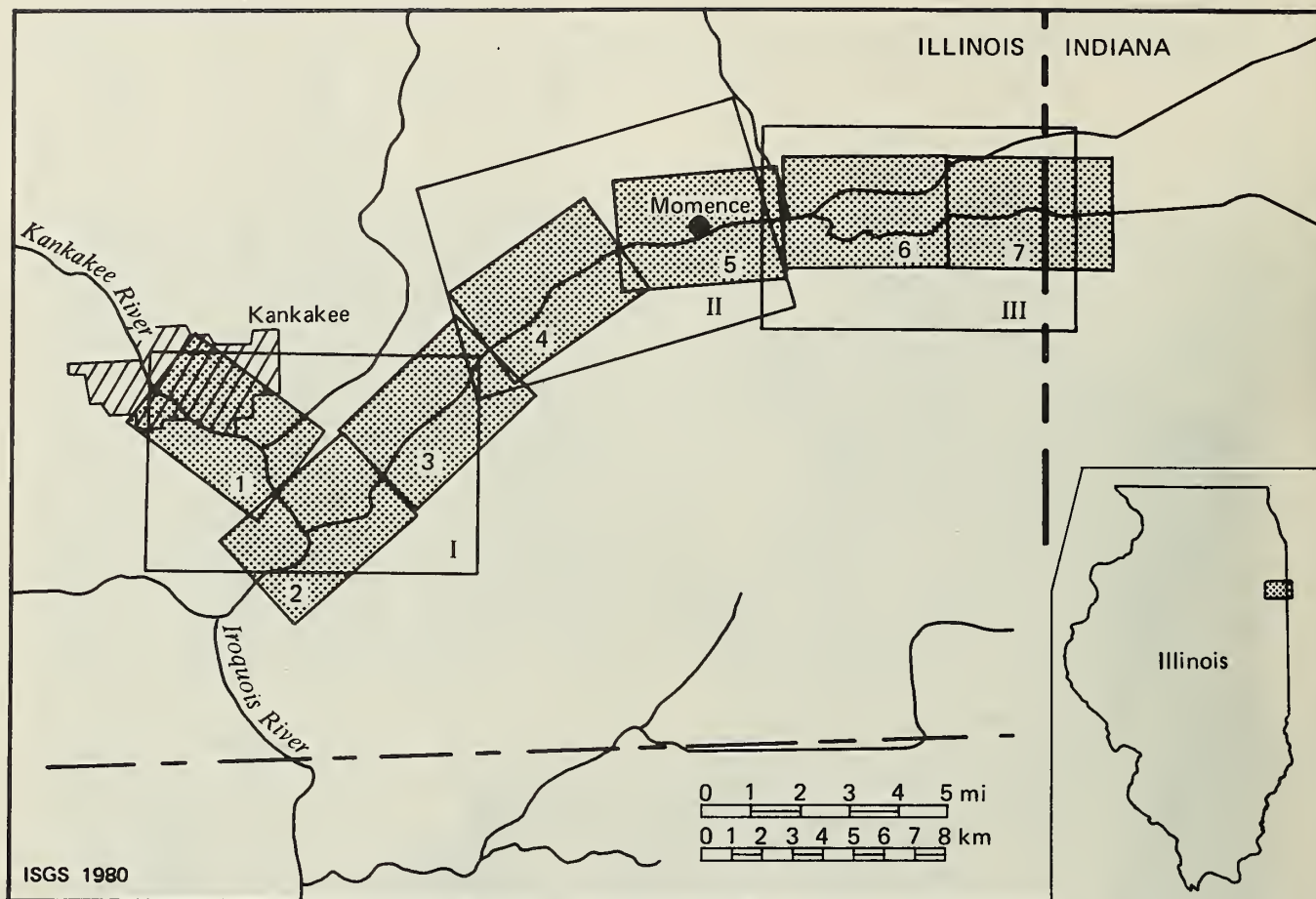


Figure 4. Index map for figures 5, 11, 12, 13, and 14.

"Kankakee River Basin, Indiana" (1976) prepared by the State of Indiana. The recently published soil survey of Kankakee County, Illinois (Paschke, 1979), was used extensively in the preparation of the geological maps in this report and for a closely related study, "Geology for Planning in Kankakee County" now underway (Kempton and others, in preparation). Figure 4 provides an index for the maps produced as part of this study. An unpublished M.S. thesis (Carnaghi, 1979) provided information on the grain size and mineralogy of the sand dunes in Kankakee County and thus provided baseline documentation for comparison with sand in the river.

METHODS

Documents

In addition to the published scientific literature and unpublished manuscripts described above, many documents are available describing the sediment in the river. These include topographic maps surveyed in 1922, 1963-64, and 1973, vertical air photos taken in 1939, 1954, 1961, and 1973, a map that is a compilation of information from 1929 and 1940, and many hundreds of drillers' logs from water wells and other test borings in the

vicinity of the river. The drillers' logs used in this report are shown in figure 5 and all are on open file at the offices of the Illinois State Geological Survey.

Maps known to be in existence, which could not be used in this report, include engineering surveys of the Kankakee River made in 1879 and 1915. Those documents were not available because they are currently at issue in the Federal litigation.

Field observations and sampling

In 1978 and 1979 an extensive program of mapping, sediment sampling, and field observations was undertaken on the Illinois portion of the Kankakee and Iroquois Rivers in the vicinity of Kankakee and Momence. Figure 6 shows the inflatable boat used in the areas between the Indiana state line and the city of Aroma Park. A research boat *OMI* was used for coring operations in Six Mile Pool (fig. 7). Sediment samples were collected from 190 locations (fig. 5). In addition, the sand thickness was measured with a steel probe at 499 locations, also shown in figure 5.

In figure 5, the points labeled as sediment cores were sampled using a Benthos coring device operated from the *OMI*. The *OMI* (fig. 7), a 26-foot, 7,000-pound, diesel-powered boat is currently on long-term loan from the Illinois Environmental Protection Agency. Operation of the Benthos coring device was described in detail by Gross et al. (1970). The device is dropped into the bottom sediment of the river where it collects a core 67 mm in diameter and up to 1 m in length (fig. 8). The *OMI* has an electric winch that is used to pull the coring device out of the bottom sediment and raise it to the deck of the boat (fig. 7). Although coring requires heavy equipment and a considerable expenditure of time, it provides the advantage of sampling the sequence of sediment residing on the bottom of the river and permits interpretation of the history of sedimentation at any one location.

To interpret the longer term history of sedimentation on the land areas adjacent to the river, four holes were drilled with the hollow stem auger drill rig (fig. 9) owned by the Illinois State Geological Survey. The locations of the test holes are shown in figure 5.

The points labeled as grab samples in figure 5 include locations where sediment was collected by a PONAR sampler (fig. 10), locations where sediment was collected by a Benthos core (fig. 8) but where only the uppermost sediment sample from the core was retained, and locations where sediment was collected from shallow water by hand (fig. 6). In all cases, the sediment samples were a homogenized sample of the uppermost 5 cm of sediment.

The points labeled as sand probe locations in figure 5 represent locations where the thickness of sand was measured by pushing a steel probe into the bottom as far as possible. The probes were sharpened on one end and had a handle on the other end—actually a series of probes of varying lengths were used. In many places it was possible to penetrate up to 2 or 2.5 m of sand before striking a hard surface. By combining measurements from the probe and information from the detailed geologic map and the map of the topography of the bedrock surface, it was possible to interpret the total thickness of sand present in the river (see figs. 11, 12, and 14).

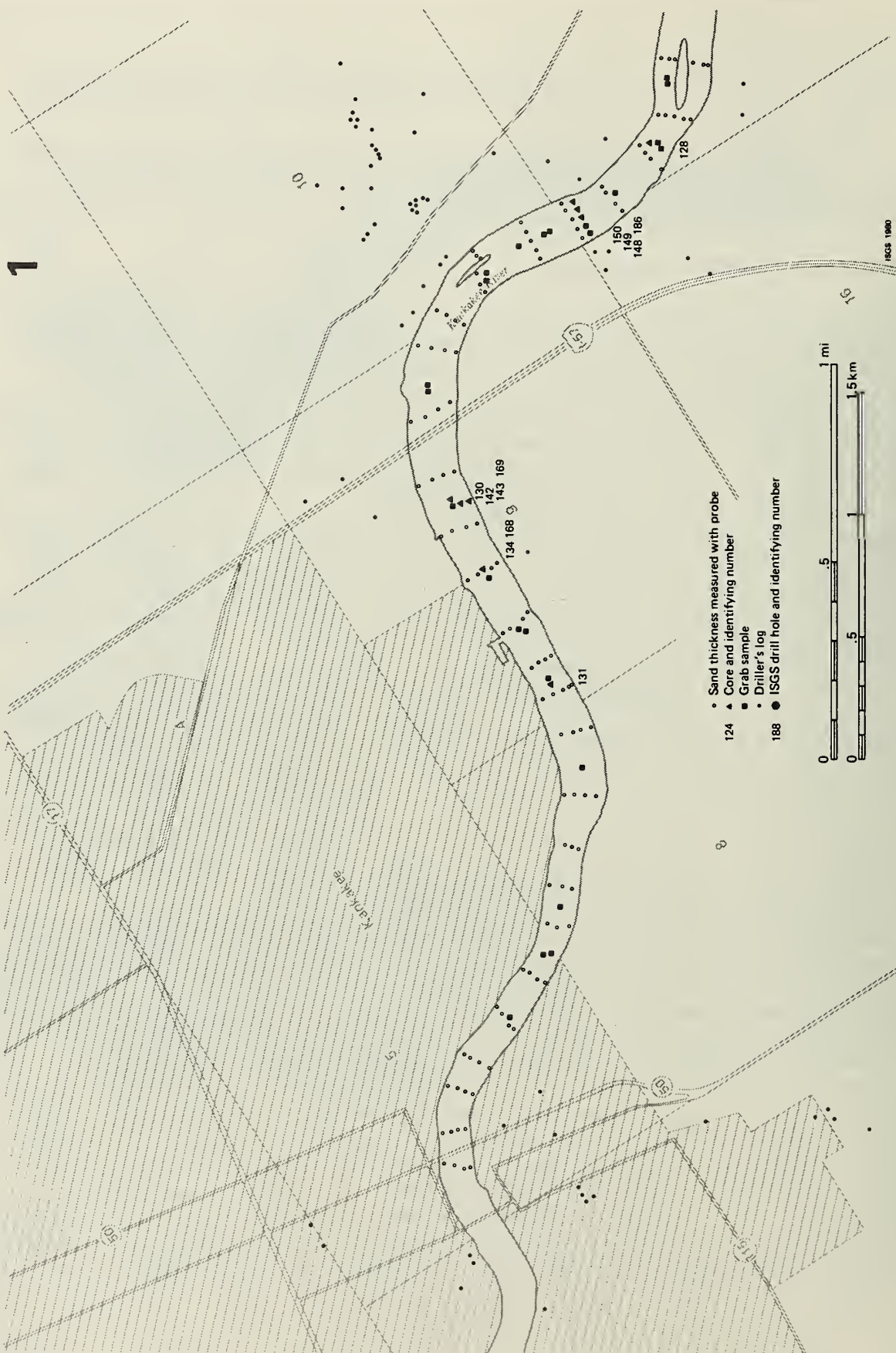


Figure 5. Map of geologic sampling points.

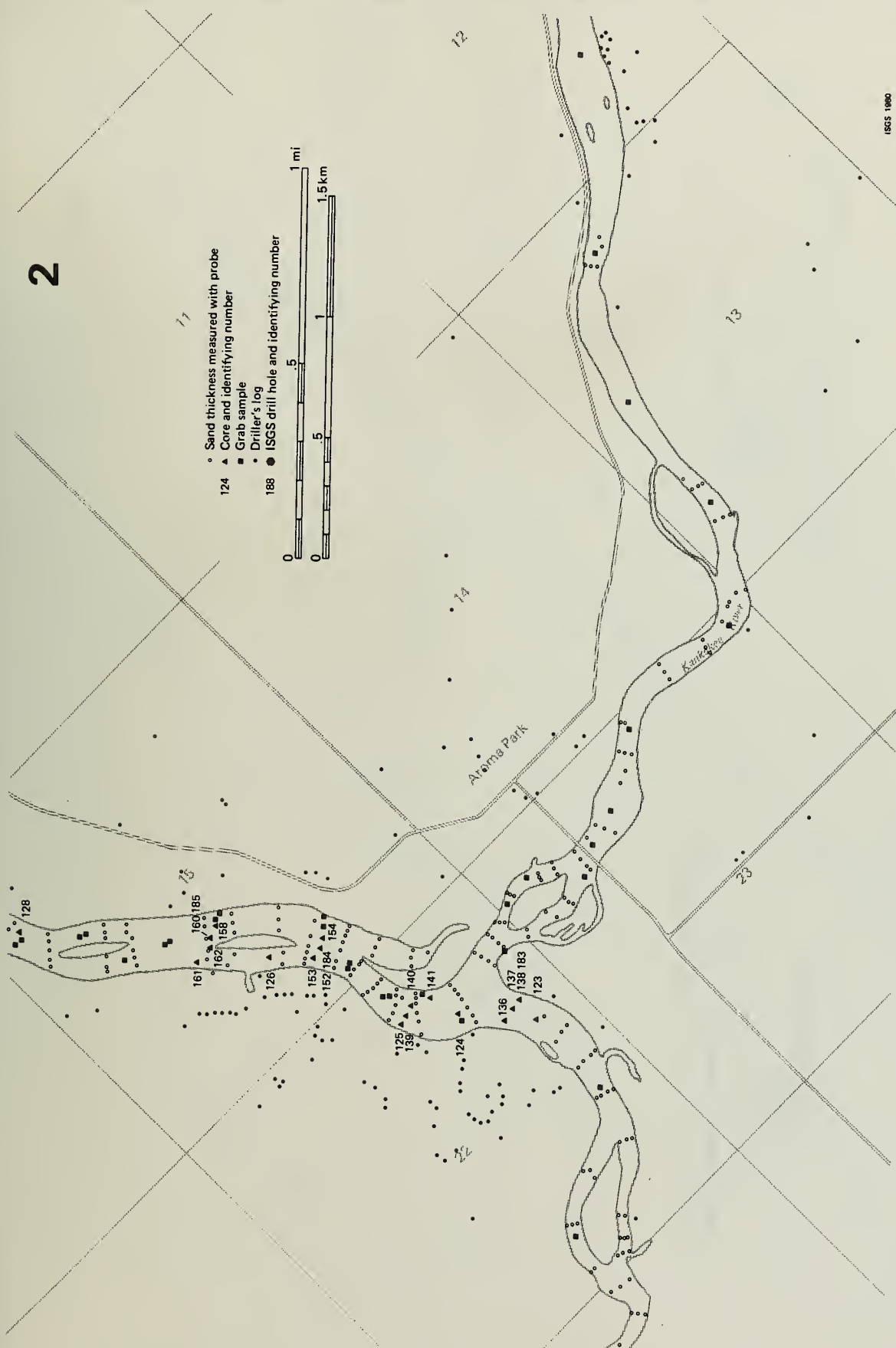


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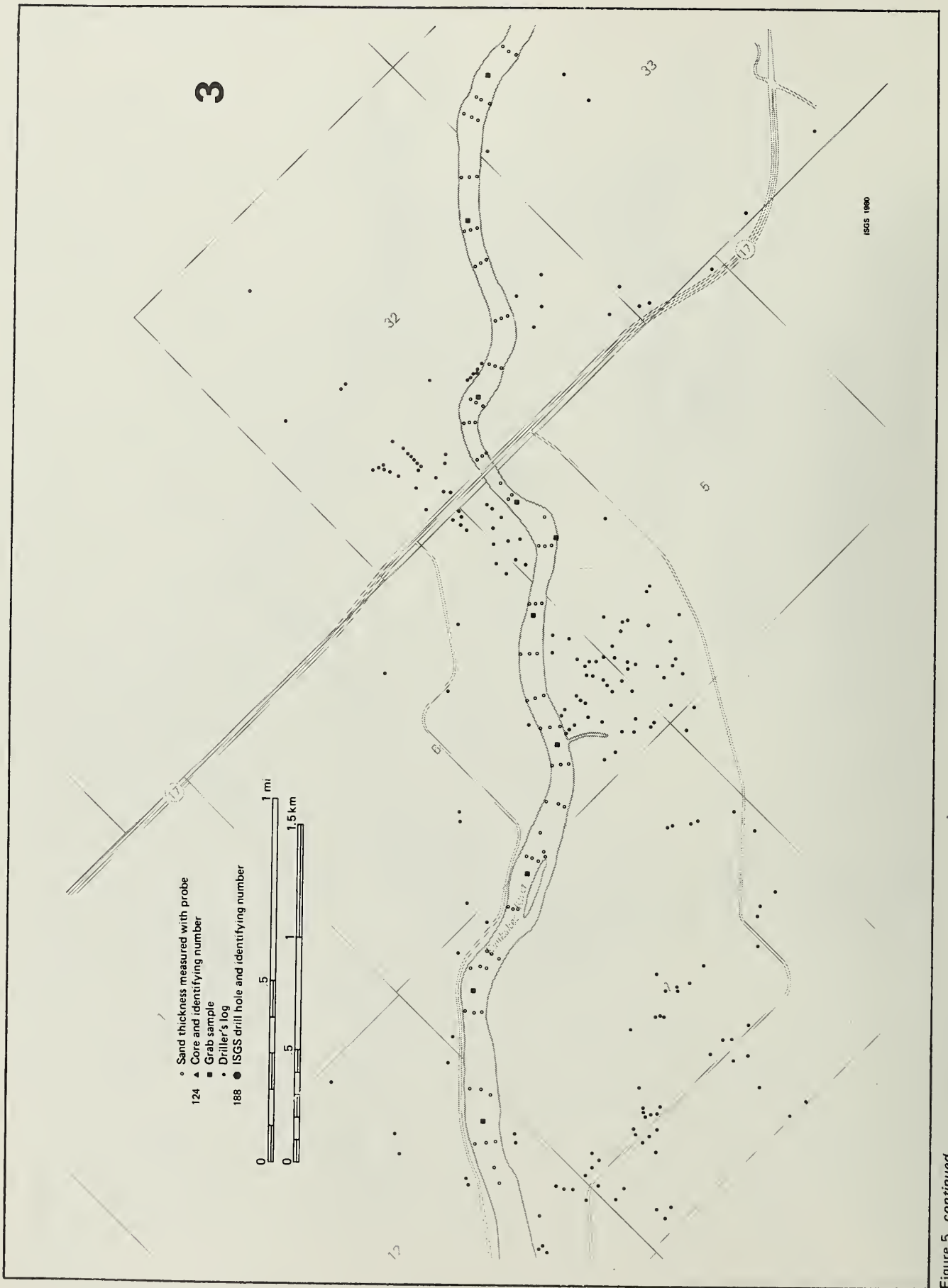
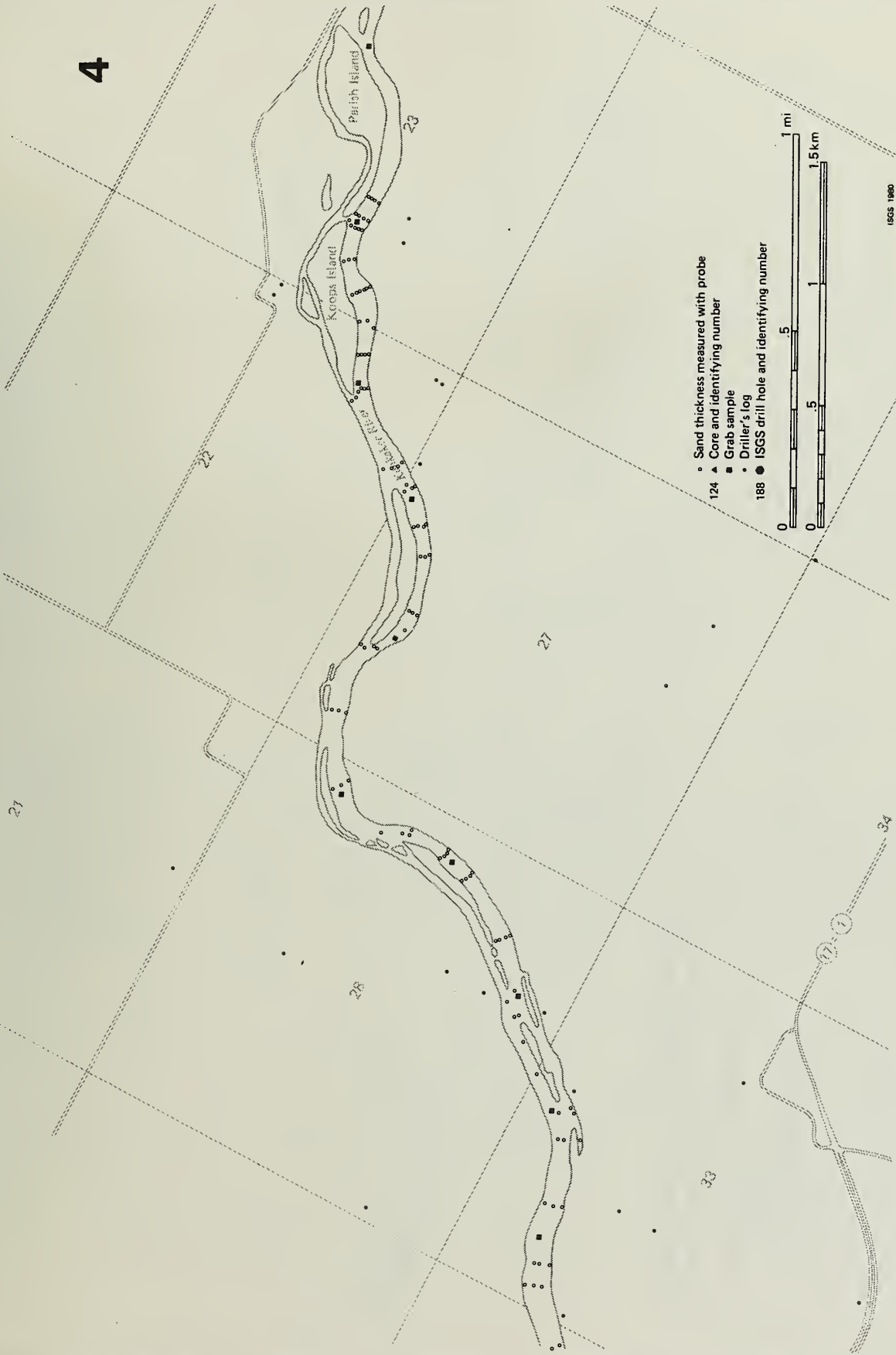


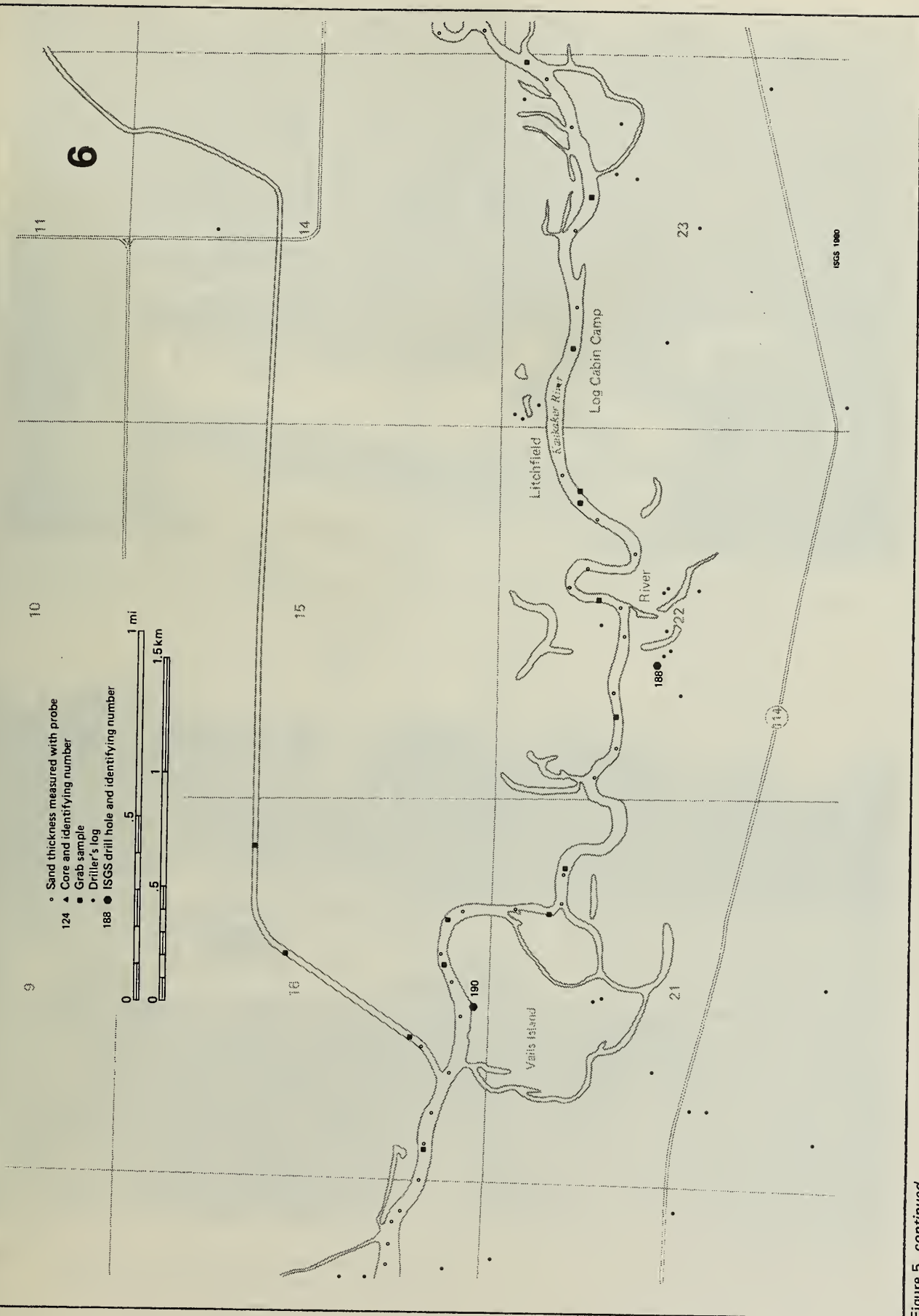
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Figure 5. continued

Figure 5. *continued*

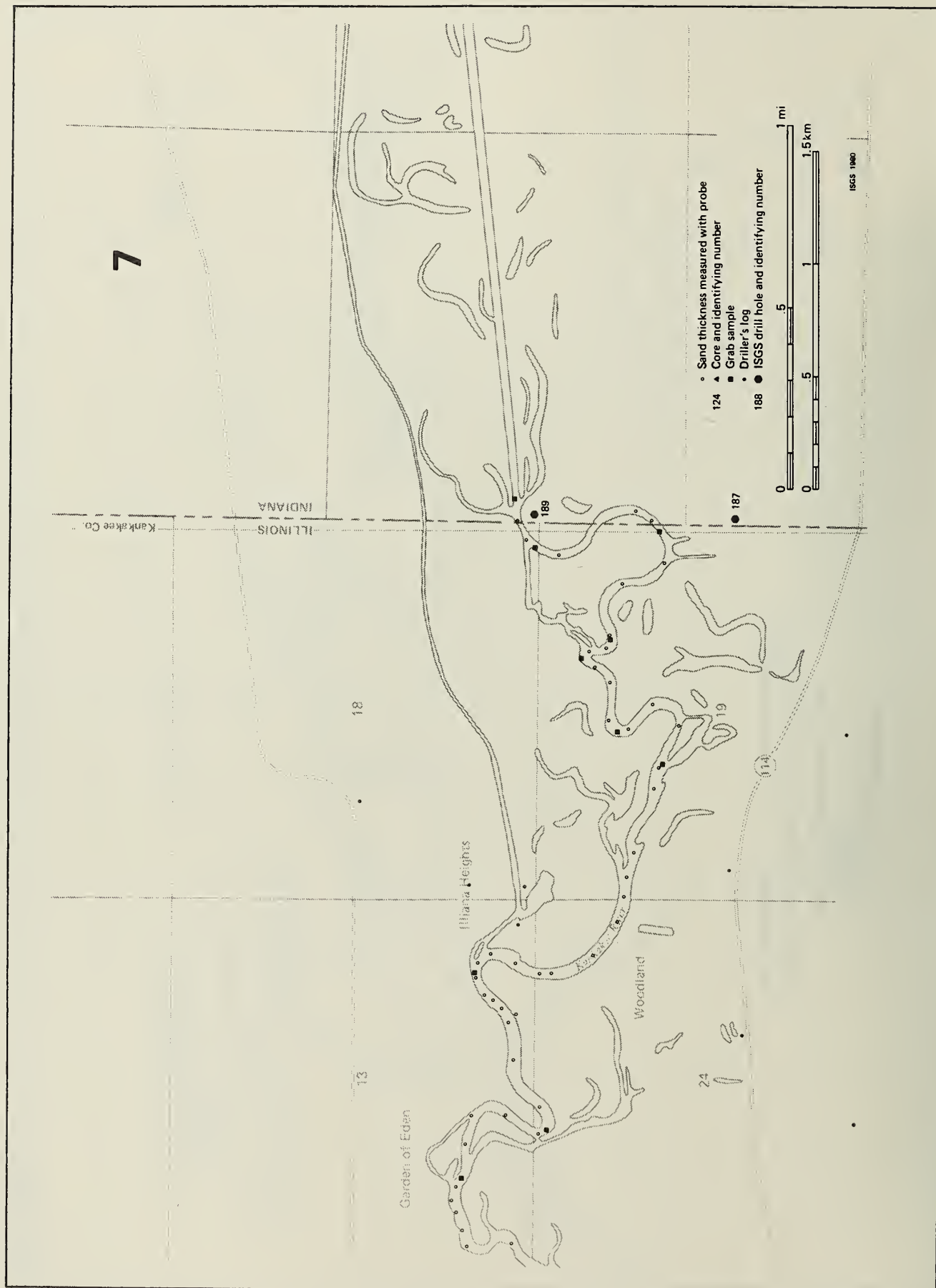


Figure 5. *concluded*



Figure 6. Photograph of the inflatable boat used to collect geologic samples from the shallow portion of the Kankakee River.



Figure 7. Photograph of the 26-foot, diesel powered, research boat used to collect sediment cores from Six Mile Pool. The Benthos coring device is hanging vertically in preparation for lowering.



Figure 8. A sediment core being extruded.

Laboratory methods

The grain size of the sediment was measured using standard pipette and sieve methods. Because the sediment proved to be of very uniform grain size (medium sand) and because extensive work on sediment grain size was done by the Illinois State Water Survey (Bhowmik, in press), the ISGS work on grain size was greatly reduced and is not reported here.

Chemical analyses were made of 19 samples from 3 cores collected from Six Mile Pool. Cores were described and subsampled in the field; then the samples were air dried, ground, and split in the laboratory prior to chemical analysis. A total of 40 elements were analyzed for each of the 19 samples for a total of 760 analyses. Those analyses included X-ray fluorescence, optical emission spectrography, atomic absorption spectrometry, and instrumental neutron activation analysis, all done by the methods described on pages 22-24 of Kothandaraman et al. (1977).

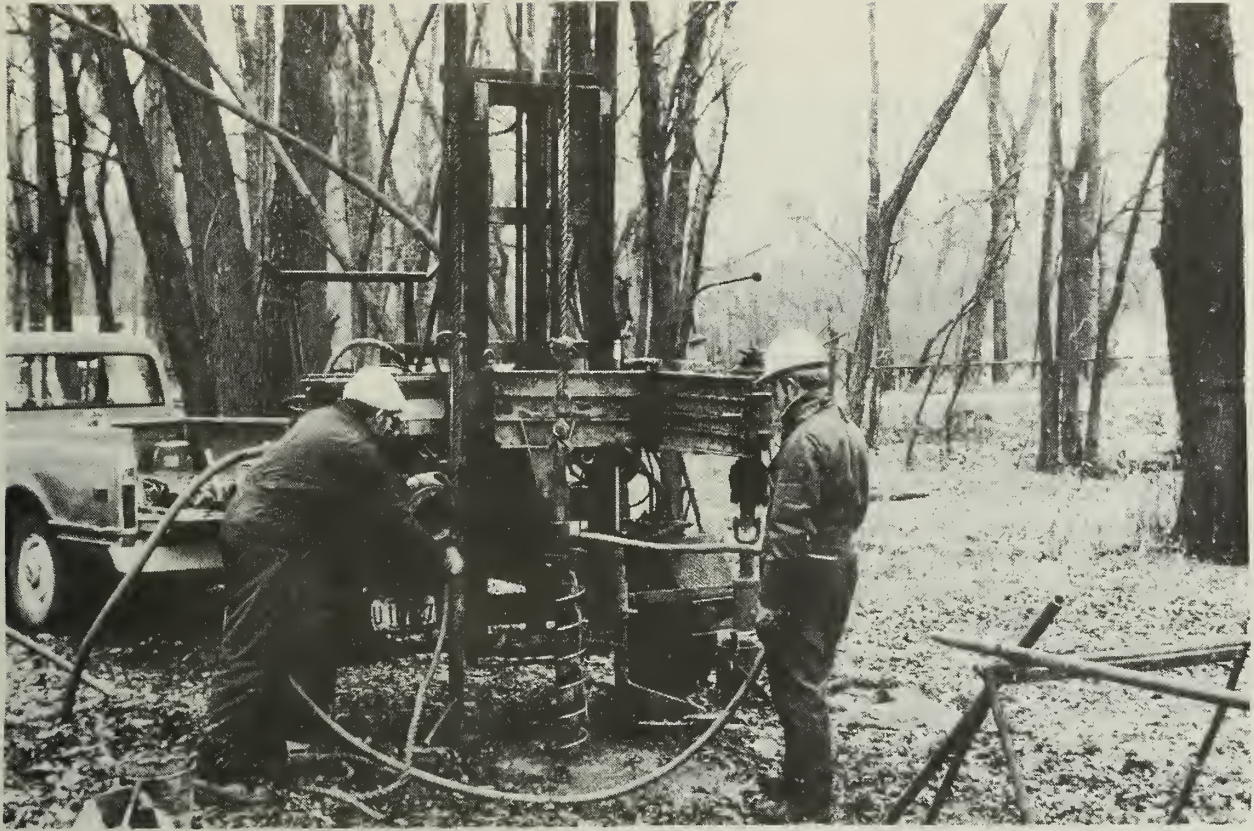


Figure 9. Photograph of hollow stem auger drilling rig.



Figure 10. Photograph of the PONAR grab sampling device.

GENERAL GEOLOGY

GEOLOGIC HISTORY

The geological materials of the Kankakee River Basin consist of a mantle of glacial deposits overlying Paleozoic bedrock. About 85 percent of the river basin in Indiana is underlain by Devonian rocks, most of which are Ellsworth Shale, Antrim Shale, and New Albany Shale. The southwestern portion of the basin in Indiana is composed of Mississippian limestone, while the northwestern portion bordering Illinois is composed of Silurian limestone and dolomite of the Wabash Formation, Louisville Limestone, Waldron Formation, and Salamonie Dolomite. These Silurian rocks generally correspond with the Racine and Joliet Formations in Illinois.

Most of the underlying bedrock within the drainage basin in Illinois is Silurian dolomite of the Racine Formation. The southern portion of the basin comprises a complex of Devonian, Pennsylvanian, and Mississippian limestones, shales, sandstones, and dolomites. The extreme northwestern portion, in western Kankakee and Will Counties, is composed of Ordovician shale (Maquoketa Shale Group) and Pennsylvanian rocks of mixed lithologies.

The geologic events responsible for the present topography and surficial deposits within the Kankakee River Basin essentially occurred over a one- or two-thousand-year interval as the last continental glaciers retreated toward their respective basins. Figure 3 shows a distribution of the surficial geological materials in the drainage basin.

Numerous moraines were constructed during Woodfordian time between 22,000 and 12,500 years B.P. In Illinois, all Woodfordian tills were deposited from the Lake Michigan glacial lobe, except in eastern Iroquois County where a Woodfordian Lake Erie glacial lobe till is found, the Iroquois Drift of the Trafalgar Formation (Johnson, 1976). On the basis of stratigraphic relationships and the history of the nearby glacial Lake Watseka (Moore, 1974), the Iroquois Drift is younger than certain Wedron Formation tills deposited about 16,000 years B.P. and older than the youngest Kankakee Flood sediments of about 14,000 to 15,000 years B.P.

The Iroquois Drift, comprised of silty and sandy materials with abundant boulders (Willman and Frye, 1970), resides over much of the southern portion of the Kankakee River Basin. The area includes in addition to a portion of Iroquois County in Illinois major portions of Newton, Jasper, and Benton Counties in Indiana (fig. 3). The drainage basin of the present-day Iroquois River corresponds with the area covered by the Erie lobe deposits and explains the abundance of suspended silt and clay materials in the Iroquois River.

About 14,000 years B.P., near the end of Woodfordian time, the Valparaiso Morainic System was constructed by the Lake Michigan glacial lobe, along the southern perimeter of Lake Michigan. Valparaiso moraines are located along the northern portion of the Kankakee River Basin (fig. 3). Major drainage-ways to the Kankakee River do not originate from these moraines. The only other morainal area in the Kankakee River Basin occurs in its extreme eastern portion in Indiana, including about the northern one-half of Marshall County, the southeastern one-quarter of St. Joseph County, and small portions of Elkhart and Kosciusko Counties (fig. 3). These moraines were constructed

by the eastward retreating glaciers of the Saginaw and Erie lobes. The position of the glacial margin of these lobes at 13,000 years B.P. was determined by Dreimanis (1977) to be in central Michigan at least 200 miles north of the Indiana-Michigan state line. Because these glaciers were positioned in east-central Illinois at about 15,000 years B.P., then the construction of the moraines in the eastern portion of the Kankakee River Basin, which is about halfway between east-central Illinois and central Michigan, was contemporaneous with the construction of the Valparaiso Moraines of the Lake Michigan lobe at about 14,000 years B.P. The headwaters of the Yellow River, a major tributary to the Kankakee River, originates in this morainal area.

As the glaciers retreated from the Kankakee River Basin to the north and east, poorly sorted sands, gravel, boulders, and cobbles were deposited in direct contact with the glacial ice, forming kames, eskers, kame terraces and deltas. Within the river basin in Illinois are two areas of ice-contact deposits: one just southeast of Aroma Park in Kankakee County, the other about 2 miles southeast of St. Anne near the Kankakee County-Iroquois County line. The deposits are more numerous in Indiana, the most extensive being in northeastern La Porte County and north-central and central St. Joseph County. Other smaller areas of ice-contact deposits in Indiana are in extreme northeastern Marshall County, northwestern Kosciusko County, near Fowler in Benton County, and near Rensselaer and in the central portion of Jasper County.

The most important geologic event shaping the landscape and the character of the deposits in the Kankakee River Basin is the Kankakee Flood. The description of the event presented here is that summarized from Willman and Frye (1970) and more recently by Carnaghi (1979). During the construction of the Valparaiso Morainic System about 14,000 years ago, drainage from the east side of the Lake Michigan lobe, the Saginaw lobe, and the north side of the Erie lobe was discharged into the Kankakee Valley. The discharge from the meltwater flooded the valley, because of a constriction in the Illinois Valley caused by the Marseilles Morainic System. At peak flow, water spread widely over the uplands resulting in numerous lakes (Lake Wauponsee, Lake Watseka, Lake Ottawa, and Lake Pontiac). The fine-grained lacustrine sediment deposited in these lakes is shown in figure 3 throughout much of Iroquois County in Illinois. The entire system according to Carnaghi (1979) aggraded upward behind a bedrock high west of Kankakee. Thick sand was deposited at this time in a wide belt along the Kankakee resulting in the large tract of sandy sediments (fig. 3) extending from west of the city of Kankakee in Illinois to South Bend in Indiana. This belt is about 20 to 25 miles wide throughout eastern Kankakee and Iroquois Counties in Illinois and in Newton, Lake, Jasper, and Porter Counties in Indiana. The sandy belt widens to more than 30 miles in Starke and La Porte Counties, Indiana. In Indiana considerable scouring of the black shale bedrock surface must have occurred prior to this deposition of sand because numerous shale fragments are incorporated into the outwash material, as shown in soil survey information (Benton, 1977). In Illinois these same fragments, which are not indigenous, are found in modern-day Kankakee River sands. Therefore, this extensive sandy deposit is a primary source area for the sediments now residing in the Kankakee River. Finer-grained lacustrine sediments were also deposited at this time, away from the main flow of the Kankakee Flood. These deposits are evident on

figure 3, south and east of the confluence of the present-day Kankakee and Iroquois Rivers in Illinois and in Jasper County, near Rensselaer in Indiana.

In addition to the wide belt of sandy deposits along the Kankakee River, a narrow belt of sandy materials lies adjacent to Iroquois River and its tributaries. These deposits appear to be a combination of slackwater deposits that were backed up into the Iroquois system from the Kankakee, as well as outwash sands that emanated from earlier Lake Michigan and Erie Lobe glaciers.

As the gap in the Marseilles Morainic System eroded, the base level of the Kankakee Flood lowered considerably. Water flow became more concentrated to the central Kankakee River Valley, and the river scoured broad areas down to the bedrock surface. Bedrock at the surface is shown on figure 3 down-river from the city of Kankakee. The erosive force of the currents deposited numerous bars of angular, bouldery rubble (Willman and Frye, 1970), as well as relatively flat-lying bouldery material, some of which may be a lag deposit. The latter occur in restricted areas west of Momence, Illinois, and south and southeast of Kankakee, Illinois. Their areal extent is too restricted to show on figure 3.

As the Kankakee Flood continued to subside, rivers became entrenched and large expanses of sandy outwash sediments left behind by the flood were exposed to eolian activity and dune building. The dune sand was derived directly from outwash sands deposited by the Kankakee Flood, which transported sediment from the erosion of local glacial deposits and bedrock as well as outwash from three retreating glacial lobes. The end result of these processes are sediments of similar lithology and appearance (Ehrlinger and Masters, 1974; and Carnaghi, 1979).

Relative stages of dune stabilization have been estimated by studying the degree of clay-iron lamellae formation in the dunes. Harris (1973) and Carnaghi (1979) suggested that dunes in southeastern Kankakee County stabilized later than those in other portions of the region, particularly those west of Kankakee. Sand dunes are shown (fig. 3) within about 10 miles south of the Kankakee and Yellow Rivers in Newton, Jasper, Starke, and Marshall Counties in Indiana, and in southeastern and west-central Kankakee County and central Iroquois County in Illinois. The most expansive dune field north of the river is located in extreme eastern Kankakee County, Illinois.

The final episode shaping the character of the geological materials in the river basin is the modern deposition of silt, sand, and gravel adjacent to the Kankakee River and its tributaries. In Illinois the material is referred to as Cahokia Alluvium. It consists of materials transported down the valley and deposited in floodplains during intervals of flooding and also includes sediments deposited directly by tributary streams (Willman and Frye, 1970). The alluvium generally rests conformably on bedrock and glacial deposits. Along the Kankakee River the material is primarily medium sand that often occurs on the sandy and gravelly Kankakee Flood materials.

SURFICIAL GEOLOGY ALONG THE KANKAKEE RIVER—STATE LINE TO KANKAKEE

A detailed map showing geological deposits adjacent to the Kankakee River from the Indiana-Illinois state line to Kankakee is shown in figure 11. This map was constructed using geologic stack units, a method of describing

unconsolidated strata to a working depth of 20 feet (6 m) (Kempton, in preparation). In a stack-unit map, each geologic unit is given a letter abbreviation of a previously named and formalized deposit (i.e., ed = Equality Formation, Dolton Member; wy = Wedron Formation, Yorkville Till Member). The surficial (uppermost) deposit is placed at the top of stack. If it is thin and discontinuous at the surface, the unit is included in parentheses, i.e., (wy). Successive geologic materials beneath the surface to a depth of 20 feet are then placed in order of their stratigraphic position in the stack, the lowest being placed on the bottom. A unit without parenthesis is present throughout the mapped area: A basal unit with parenthesis may be present within the mapped area or just below 20 feet (i.e., $\frac{ed}{wy}$).

The surficial geological materials were initially determined by examining soil survey maps for Kankakee County (Paschke, 1979). Soil series were classified into parent material areas. The geologic information was then compiled, including specific surficial and subsurface data and regional mapping and interpretations. The final stack-unit geologic materials map was prepared by integrating both soil and geological information. The map shown in figure 11 is a portion of a map prepared for a larger study by Kempton and others (in preparation) on the geology of Kankakee County.

From the Indiana-Illinois state line to about 1 mile east of the city limit of Momence, a distance of about 7 miles, the dominant geological materials are Cahokia Alluvium (c) resting over sand of the Dolton Member (ed) of the Equality Formation. Cahokia Alluvium represents modern flood-plain deposits of the Kankakee River. There does not appear to be any differentiation between pre-channelization and post-channelization flood materials. Dolton Member deposits of the Equality Formation found beneath Cahokia Alluvium and beyond the limits of the modern alluvium are generally composed of medium-textured sand. This is the material that most directly relates to the Kankakee Flood. Also important along this reach of the Kankakee River is the presence of a Silurian bedrock high (s) in the western portion of Illiana Heights (this is indicated by Cahokia Alluvium over Equality, over Silurian bedrock, all within 20 feet of the surface), and Parkland Sand deposits (pl), which is an eolian material. The eolian material represents deposits that were eroded by the wind following the deposition of huge volumes of sand during the Kankakee Flood. The largest areas of Parkland Sand are north and west of Illiana Heights, north of Litchfield, and south of River.

Starting at the confluence of Trim Creek with the Kankakee River about 1.5 miles east of Momence, bedrock is near the surface. Bedrock dominates the basal stack unit from this point downriver to the limit of mapping for this report, which is the city of Kankakee.

In general, the distribution of geological materials along the Kankakee River from Momence to Kankakee is relatively simple. Cahokia Alluvium often is a result of overbank sedimentation. It also occurs in depressional or level areas, on the inside of meander bends, on islands within the Kankakee (including Parish Island, Koops Island, Maple Island, and Eagle Island), and in small drainageways and creeks (see Spring Creek, just east of Aroma Park).

Sand deposits of the Dolton Member (Equality Formation) occur along the entire river as the surficial material, or underlying Cahokia Alluvium

Legend for Figure 11

sm	Surface mines	Rock quarries; clay, sand, or gravel pits; and other excavated areas, including those where the mixed fill of bedrock or Quaternary deposits was replaced or disturbed.
c	Cahokia Alluvium	Deposits in floodplains and channels of modern rivers and streams; mostly poorly sorted sand, silt, or clay containing local deposits of sandy gravel.
py	Peyton Colluvium	Deposits of largely unsorted debris resulted from creep and slope wash and accumulated on and at the base of river bluffs.
pl	Parkland Sand	Windblown sand; well-sorted, medium-grained sand in dunes and thick sheet deposits between dunes.
gl	Grayslake Peat	Peat, muck, and marl; dominantly organic deposits that are interbedded with silt and clay in some places.
ec	Carmi Member of Equality Formation	Largely quiet-water lake sediments dominated by well-bedded silt and some clay; includes sediment of proglacial lakes and slack-water lakes in valleys tributary to major river valleys.
ed	Dolton Member of Equality Formation	Largely shallow-water, nearshore lake sediments in beaches, bars, spits, and deltas; includes some former lakes that contain coarse-grained deposits; dominantly medium-grained sand; some gravel along beaches.
w-o	Wedron Formation outwash	Bouldery material that is either a lag deposit or outwash deposit in restricted areas along the Kankakee River.
wy	Yorkville Till Member of Wedron Formation	Mostly gray clayey and silty clayey glacial till.
s	Silurian bedrock	Dolomite bedrock

Materials are mapped to a depth of 20 feet (6 meters)

() indicates formation is discontinuous and may be absent

Examples: wy Yorkville Till more than 20 feet thick

pl Parkland Sand less than 20 feet thick overlying
ed Dolton Member of Equality Formation

c Cahokia Alluvium overlying
(ed) discontinuous Dolton Member of Equality Formation
s overlying Silurian bedrock, all within 20 feet of the surface

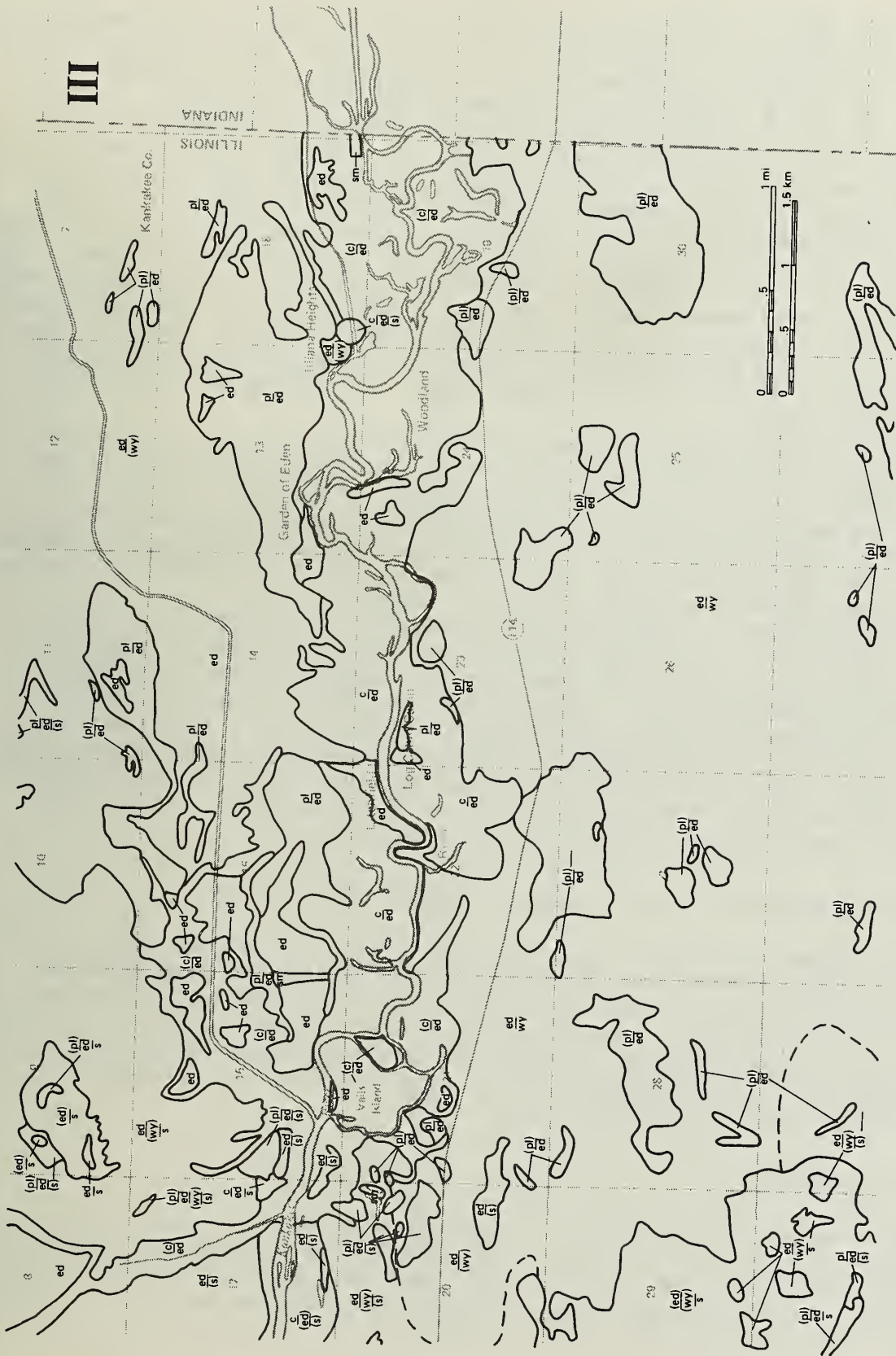


Figure 11. concluded

or Parkland Sand, or above Silurian bedrock (s) or Yorkville Till Member (wy) of the Wedron Formation. The till occurs mostly north of the river from Momence to about 1 mile upriver from Aroma Park. Yorkville Till is also present to a depth of 20 feet over the central portion of the city of Kankakee. South of the river, till occurs less commonly, either because thick deposits of Parkland Sand and/or Dolton sands cover the till, or the till was removed by scour.

Parkland Sand deposits occur in restricted dunes mostly south of the Kankakee River from near Momence to where State Road 17 crosses the river. Some of these dunes are 30 to 40 feet high. From State Road 17 to near Interstate 57, Parkland Sand dominates the land area south of the river and is an extension of the belt of eolian deposits shown on figure 3, which occupy much of southeastern Kankakee County. The belt crosses the river near Aroma Park, where eolian sand occurs in a discontinuous surficial layer. West of Interstate 57, the land area adjacent to the river is dominated by bedrock near the surface overlain by a discontinuous layer of Dolton sand and possibly some Yorkville Till.

The only other deposits shown on figure 11 not discussed thus far are restricted occurrences of Peyton Colluvium (py), Grayslake Peat (gl), and Carmi Member (ec) silty-clay deposits. Peyton Colluvium (py) occurs in restricted depressional areas all along the Kankakee River. This deposit is largely unsorted debris that resulted from creep and slope wash accumulating on or at the base of river bluffs. The largest area of Peyton Colluvium occurs about one-half mile west of Eagle Island.

Grayslake Peat is dominantly organic deposits interbedded with silt and clay. The largest occurrence of this material is found over Dolton sand, on the south side of the river about one-mile south of where State Road 17 crosses the Kankakee River. Carmi deposits occur at the base of the till bluff, near Baker Creek east of Kankakee; this is its only occurrence near the river. Silt and clay Carmi deposits represent quiet-water sedimentation conditions. These fine-textured sediments also dominate till upland regions several miles north of the river as well as lowland regions, east of the Iroquois River near the Kankakee County-Iroquois County line.

BEDROCK TOPOGRAPHY AND SAND THICKNESS ADJACENT TO THE RIVER

Figure 12 shows the bedrock topography and figure 13 shows the thickness of sand near the Kankakee River from the Indiana-Illinois state line to Kankakee. These maps were constructed by plotting stratigraphic data from several hundred well logs on file in the Geological Record Section of the Illinois State Geological Survey. These data were augmented by plotting the data from holes specifically drilled in November 1979 to analyze the sediment and determine the thickness of sand for the Kankakee River project.

Bedrock topography

The map of bedrock topography (fig. 12) is contoured at a 5-foot interval in some areas and at a 25-foot interval in other areas depending on the density of data points along the river. The data are displayed as elevations above sea level. In general, the range in elevation of the bedrock surface within 1 mile of the river is 575 to 625 feet.

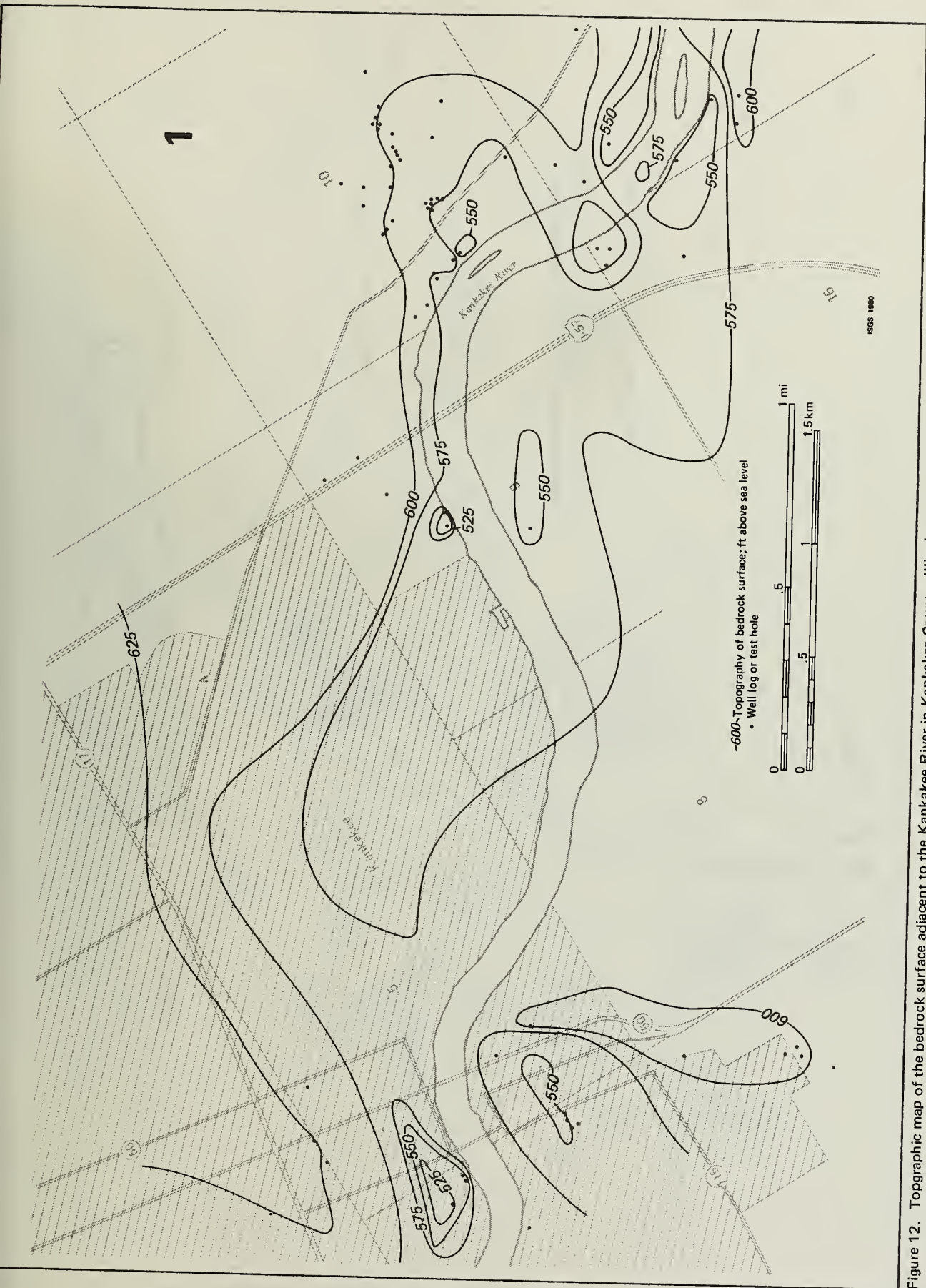


Figure 12. Topographic map of the bedrock surface adjacent to the Kankakee River in Kankakee County, Illinois.

2

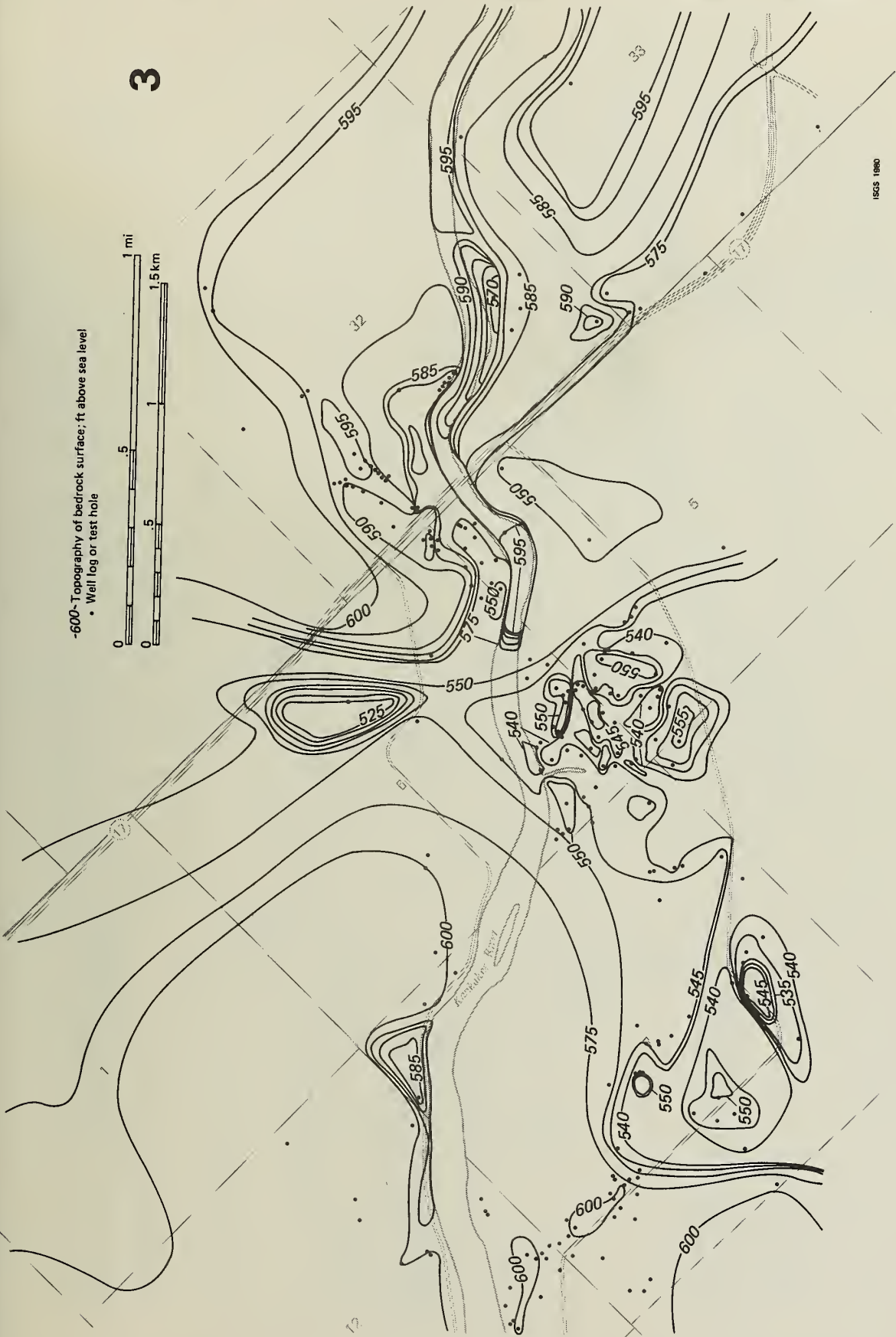
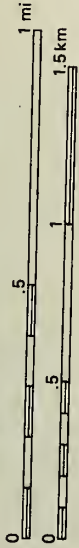


ISCS 1980

Figure 12. continued

3

-600- Topography of bedrock surface, ft above sea level
 • Well log or test hole

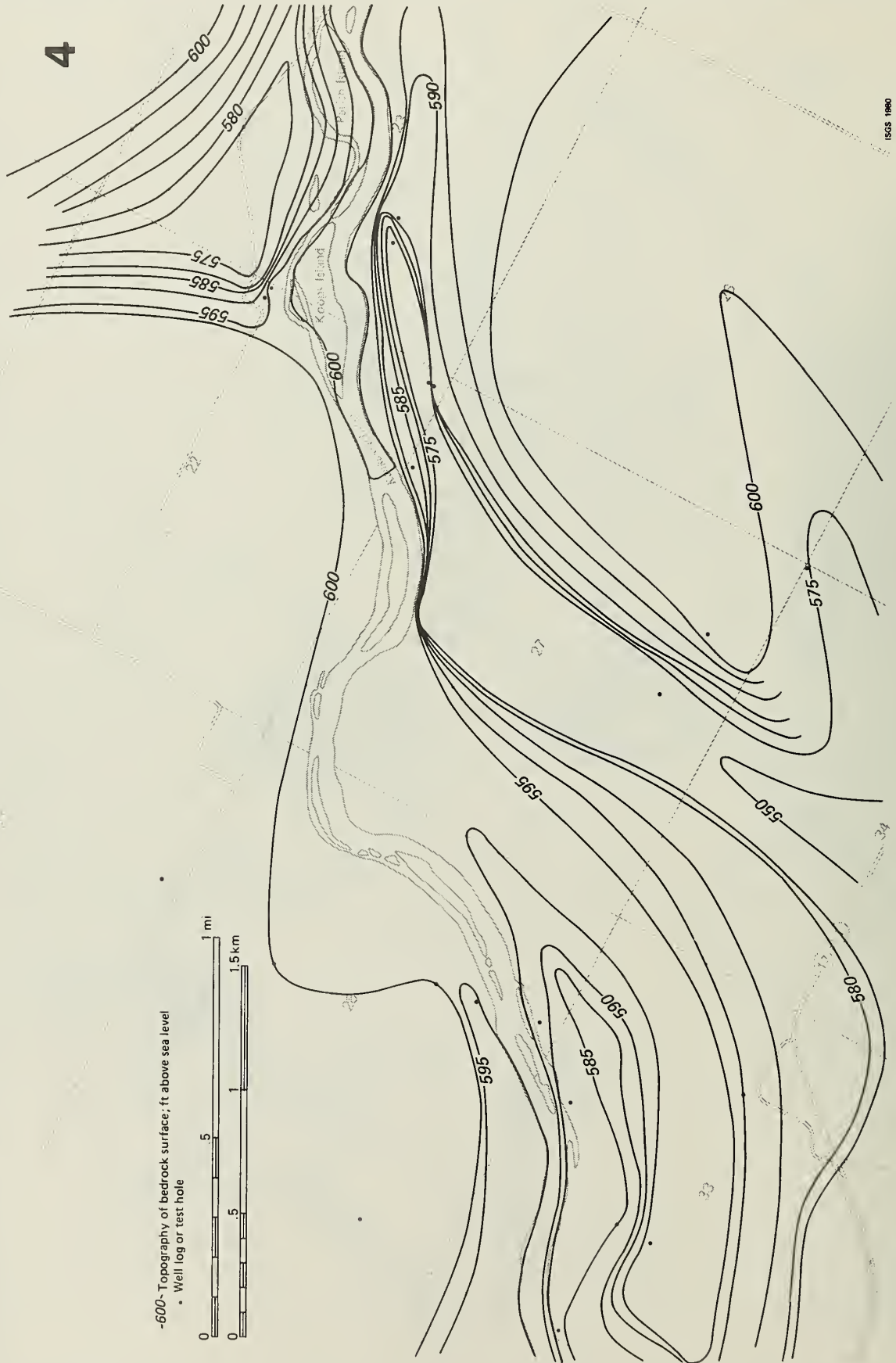
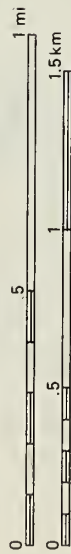


ISGS 1980

Figure 12. continued

4

-600- Topography of bedrock surface; ft above sea level
 • Well log or test hole



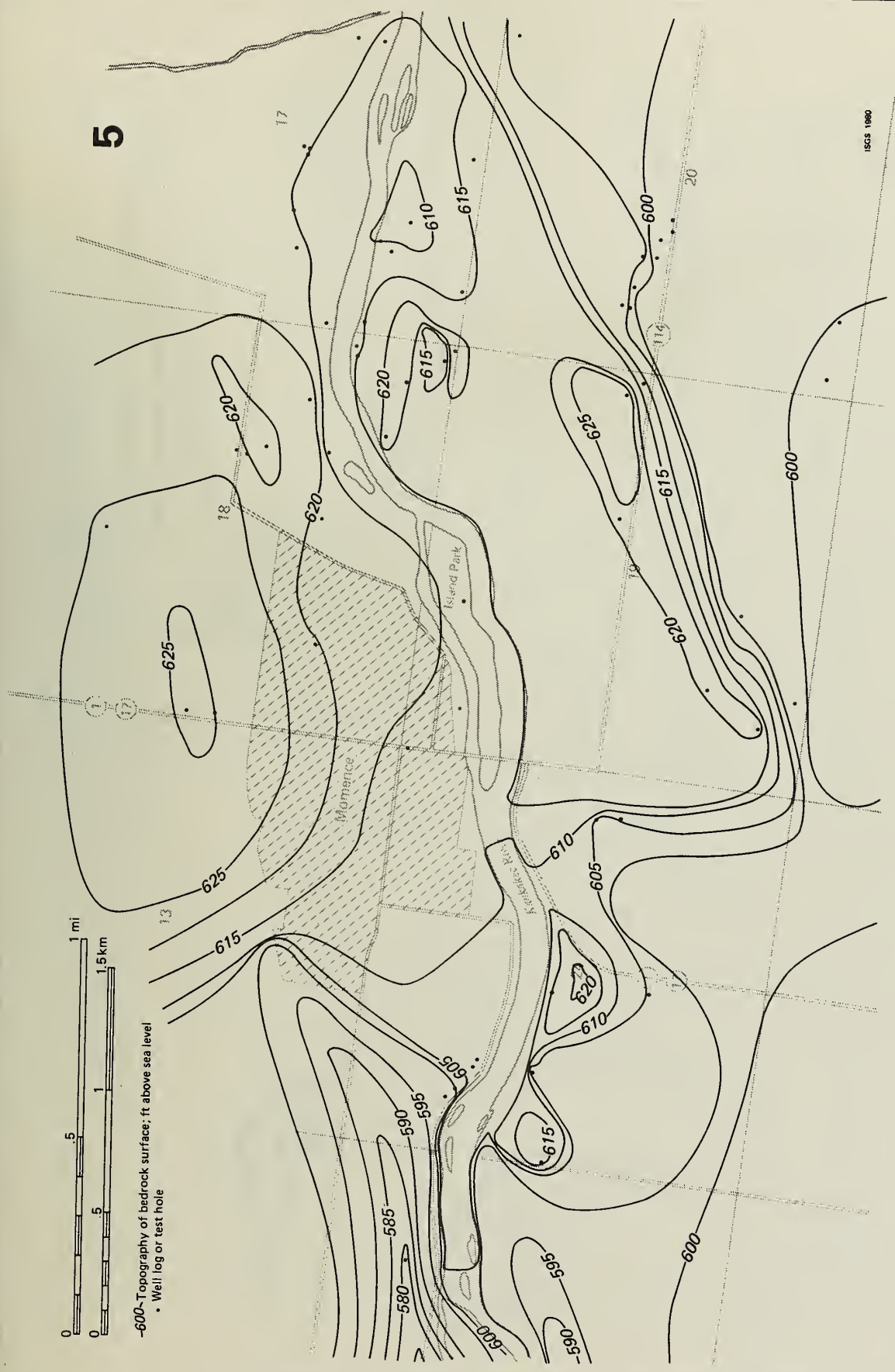
USGS 1980

Figure 12. continued

5

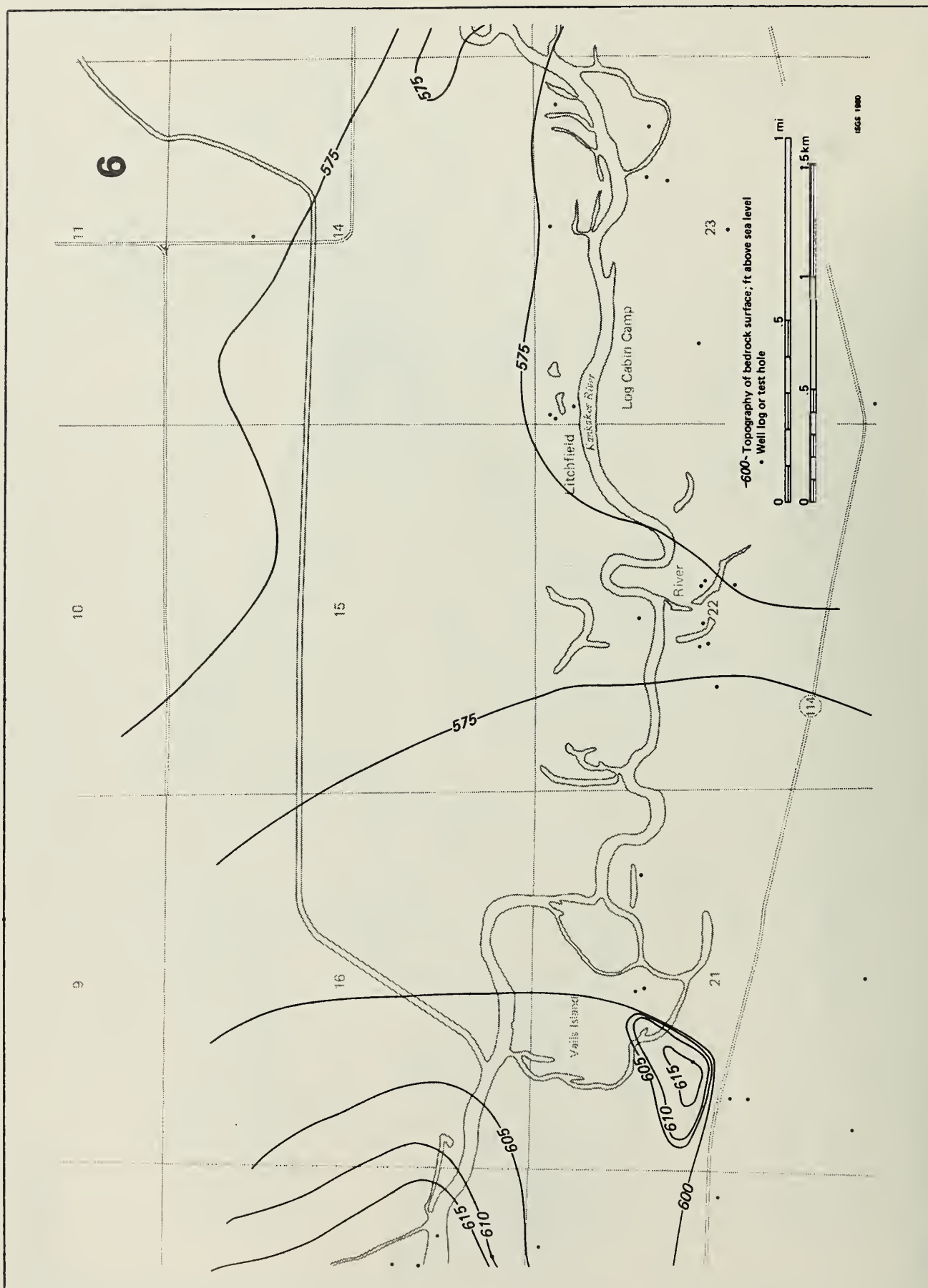


-600- Topography of bedrock surface; ft above sea level
 • Well log or test hole



ISCS 1080

Figure 12. continued



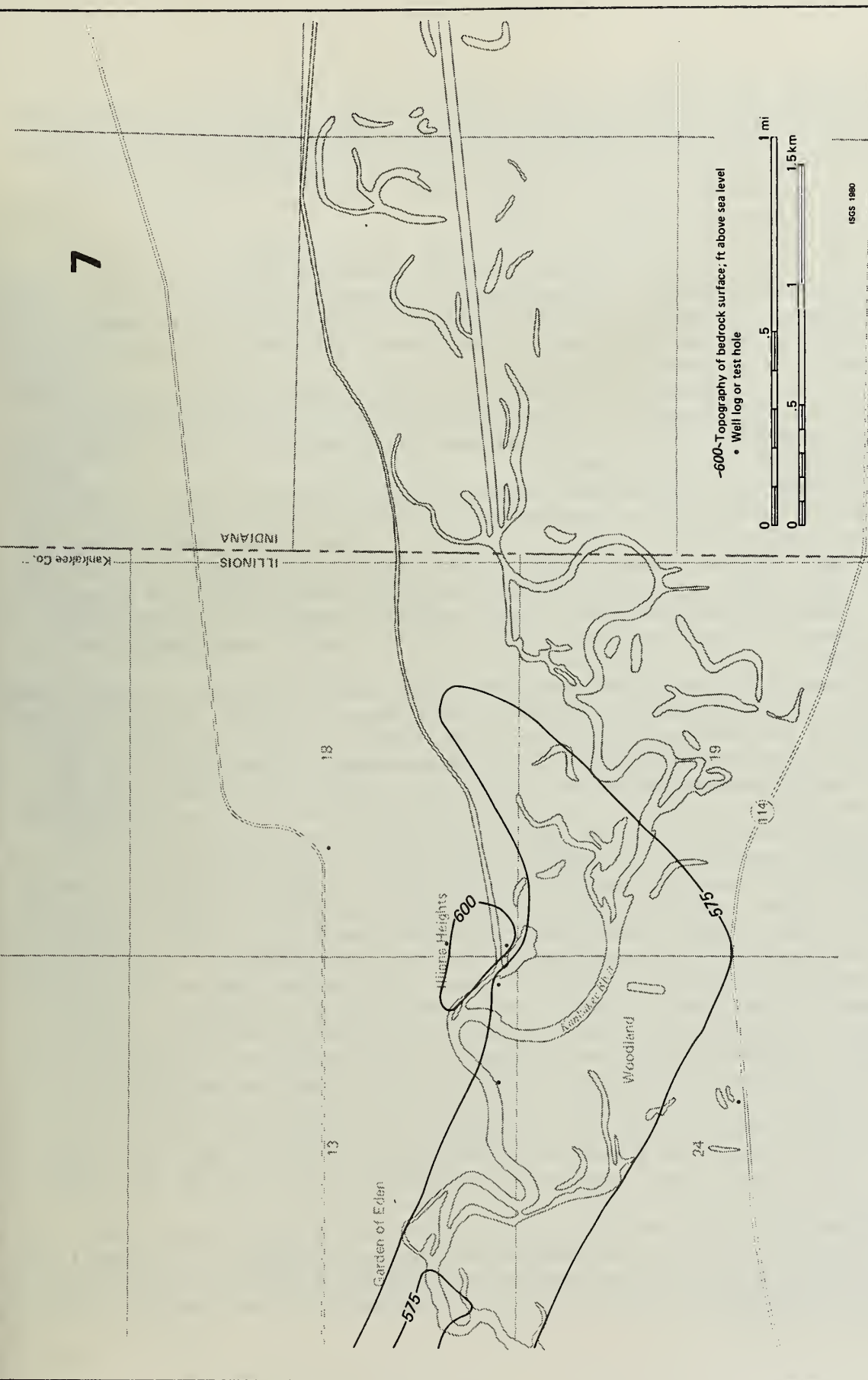


Figure 12. concluded

Between the Indiana-Illinois state line and a point about one-quarter mile west of River, the bedrock is about 575 feet above sea level, which is approximately 50 feet beneath the surface. Two restricted bedrock highs occur in this reach: one in the south part of Illiana Heights, where the elevation exceeds 600 feet; the other, about 1 mile west of Illiana Heights, where the elevation is above 575 feet.

From west of River to about 1.5 miles east of Momence (a distance of about 1.5 miles), the bedrock surface rises from 575 feet to 615 feet. A slight depression exists, with elevations ranging from 610 to 615 feet, from the point east of Momence to either side of Island Park south of Momence. This 2-mile reach, where bedrock is at or near the surface, is commonly referred to as the Momence Ledge.

Just west of Momence, the bedrock surface drops from 600 to about 580 feet near Parish Island as a bedrock valley enters from the northwest. Bouldery material (fig. 11) was deposited by the Kankakee Flood in the eastern portion of this valley.

From Parish Island to about one-quarter mile upriver of the Illinois State Road 17 bridge, the Kankakee River is flowing on a bedrock high. The 595- and 600-foot contour lines are adjacent to the river over this 4-mile reach, and a bedrock valley 10 to 25 feet lower exists adjacent to the south bank of the river. This same phenomenon occurs along much of the Kankakee River. Carnaghi (1979) explained that as the base level of the Kankakee River lowered, it was possible for the river to become superimposed and entrenched.

The valley may represent the main river channel that was occupied during the scour cycle following the peak Kankakee Flood. Filling of the low areas by sand may have followed the scour cycle while the river was positioned over the higher bedrock areas. Slight entrenchment of the river into the bedrock may have occurred at this time and in part is responsible for the river not wandering into the low areas occupied by the more easily erodible unconsolidated materials. The youthfulness of the river may also be responsible for meander wanderings not yet cutting into the valleys.

Extending from about one-half mile upriver of the State Road 17 bridge to about 2 miles south of the bridge, there are a series of depressional areas on either side of the river. The depressions do not appear interconnected nor do they appear associated with the upriver bedrock valley system described above. Rather, it appears that these features are either scour holes due to the Kankakee Flood or are due to glacial plucking. In any event the Kankakee River generally flows on the bedrock high that meanders through the depressions. Other depressions adjacent to the river exist southwest of Aroma Park, at the confluence of the Kankakee and Iroquois Rivers, and at the west end of Six Mile Pool in the city of Kankakee. The most dramatic occurrence of this phenomenon is at the latter area. The river is superimposed on a bedrock high at an elevation of about 580 feet. However, on either bank of the river, the bedrock surface drops to between 550 and 525 feet.

The bedrock topography along the river from its junction with the Iroquois River to the city of Kankakee is relatively simple. In general, the 575-foot contour encloses most of the area except for a few depressions mentioned above and local bedrock highs. The bedrock highs are located

about 1 mile downriver of the confluence of the Kankakee River and the Iroquois River, about one-half mile upriver of the I-57 highway bridge, and near State Road 50 on the south side of the river in Kankakee.

Thickness of sand

The map of sand thickness (fig. 13) is contoured in 5-foot intervals. Sand is not shown on the map in numerous areas adjacent to the river because it was not indicated in drillers' logs, however, 1 or 2 feet of sand may exist. This accounts for some of the discrepancies with the detailed geologic map. The materials shown on these maps are a combination of the sand contained in Cahokia Alluvium and Dolton Member deposits.

From the Indiana-Illinois state line to Vails Island, the sand thickness adjacent to the river is generally between 20 and 30 feet. Two areas of thinner deposits occur in this reach: in the south part of Illiana Heights (this is the bedrock high area mentioned earlier), and on the south bank of the river, south of Illiana Heights. At both areas the thickness of sand is about 15 feet.

From Vails Island to the confluence of Trim Creek with the Kankakee River, the thickness of sand decreases from 30 feet to 0. Then, for a 2.5-mile reach across the "Momence Ledge," there are no significant amounts of sand on either bank. Downriver from Momence, the sand adjacent to the river begins to increase, particularly, just west of Momence, and along the south bank of the river from Koops Island to near the State Road 17 bridge. The thicker deposits of sand here are due to local sand dunes and the sand contained in bedrock valleys. Sand along this reach is generally 10 to 20 feet thick on the flat-lying topography on the south side of the river. On the north side of the river, the sand is generally between 5 and 10 feet thick.

Along the 5-mile reach of the river from near the bridge at State Road 17 to the confluence of the Kankakee River with the Iroquois River, the sand is in pockets 10 to 50 feet thick. These pockets or scour holes can be identified on the map of bedrock topography (fig. 12). The largest pockets of sand occur just south of the State Road 17 bridge, about 1.5 miles southeast of Aroma Park, and at the junction of the Kankakee and Iroquois Rivers. Along much of this reach, sand thickness decreases away from the north bank of the Kankakee River; this suggests either overbank sedimentation or deposition of valley fill materials as the Kankakee Flood subsided. Along the south bank of the river, on the same 5-mile reach, the thickness of sand generally increases. This is due to the presence of sand dunes, which represent the westward edge of the belt of sandy deposits that dominate much of southeastern Kankakee County. The sand in flat-lying areas in this region is generally between 10 and 20 feet thick and increases to more than 100 feet thick about 8 miles west of the river.

From the junction of the Kankakee River with the Iroquois River to the city of Kankakee, the adjacent land area is characterized by little if any sand. Four small sand pockets, northwest of Aroma Park and on either side of the river at the bridge crossings in Kankakee, are the only significant deposits of sand along this reach. Most of the area is underlain by glacial till over bedrock.

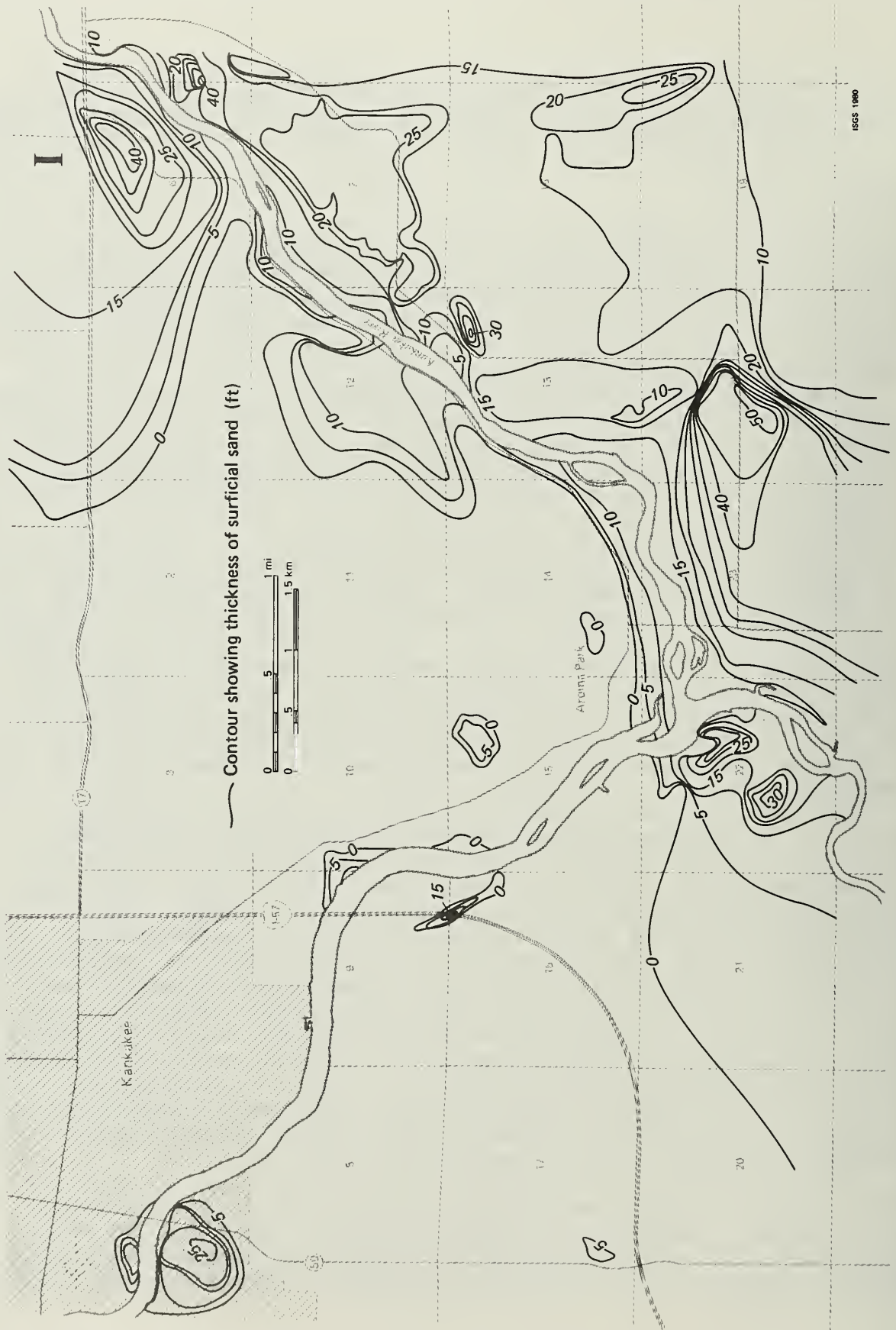


Figure 13. Map of the thickness of sand deposits adjacent to the Kankakee River in Kankakee County, Illinois.

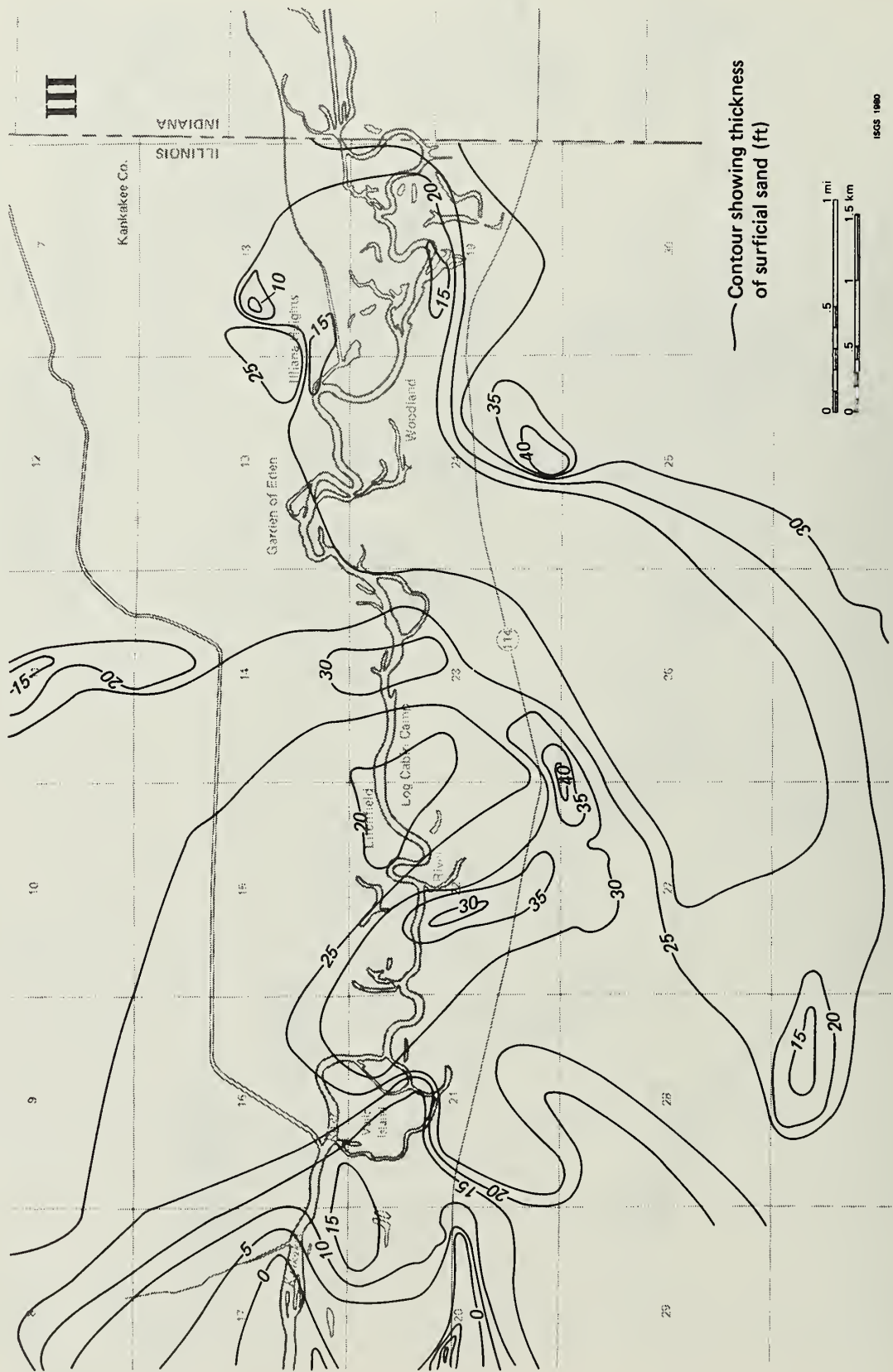


Figure 13. concluded

GEOLOGY OF SEDIMENT IN RIVER

THICKNESS AND DISTRIBUTION OF SEDIMENT

The thickness and distribution of sediment in the Kankakee River is shown in a 14-part map (fig. 14). The map is based on field work conducted in 1978 and 1979. The bed of the Kankakee River from the Indiana-Illinois state line to the city of Kankakee was probed with a steel rod to determine the thickness of sediment over bedrock. The locations of these measurements are shown on Figure 5. A hard bottom in most cases was bedrock; however, in some instances it was local gravel deposits. In many areas the thickness of sand exceeded the depth of the probe, or the probe could not be pushed farther into the sediment. This was the situation in the Momence Wetlands from the state line to east of Momence, and in restricted locations elsewhere in the river. Because the hard bottom in some instances was local gravel deposits and in other instances could not be determined, the map depicts the minimum thickness of sand in the river.

The most reliable information on the thickness and character of the sediment in the river was derived from core data. However, the need for a heavy boat to transport the coring device, which was a Benthos gravity corer, restricted coring activity to the Six Mile Pool area of the Kankakee River.

Along this reach of the river, 34 cores were collected. The depth of penetration of the cores was not sufficient to determine the character and thickness of the sediment down to the bedrock surface; hence the steel rod probe augmented the coring activity to determine the total thickness of sediment. Throughout the entire Kankakee River from the state line to the city of Kankakee, including a 2-mile portion of the Iroquois River, 499 probes were done. Downriver from the Momence Wetlands area, probing cross sections of the river were made at 500 to 1,000-foot intervals. The length of the cores and probes was recorded in centimeters.

The materials in the river are of two major types: unconsolidated sediment and bedrock. The bedrock, as mentioned previously, consists primarily of Silurian dolomite of the Racine Formation. The sediment in the river is mostly a medium-textured sand. However, silty sediments occur in some places within the recreational pool area of the river. The silty material occurs mostly in depressions in the bedrock channel and possibly represents a yearly influx of fine-grained material from the Iroquois River.

The thickness of sediment in most of the Kankakee River between the state line and just east of Momence could not be determined because of the inability to differentiate recent river sand from underlying Kankakee Flood sand, which is at least 20 feet thick. Because of the swiftness of the current along this reach and sand binding problems, the probe was inserted only about 1 m into the sediment. Probes were made only in the midchannel every 500 to 1,000 feet.

Two areas where bedrock is encountered beneath the river sand along this reach are at the two northerly extending meander bends near Illiana Heights. This is also shown on the geologic map of the region (fig. 11). The sand at both of these locales is between 20 and 50 cm thick.

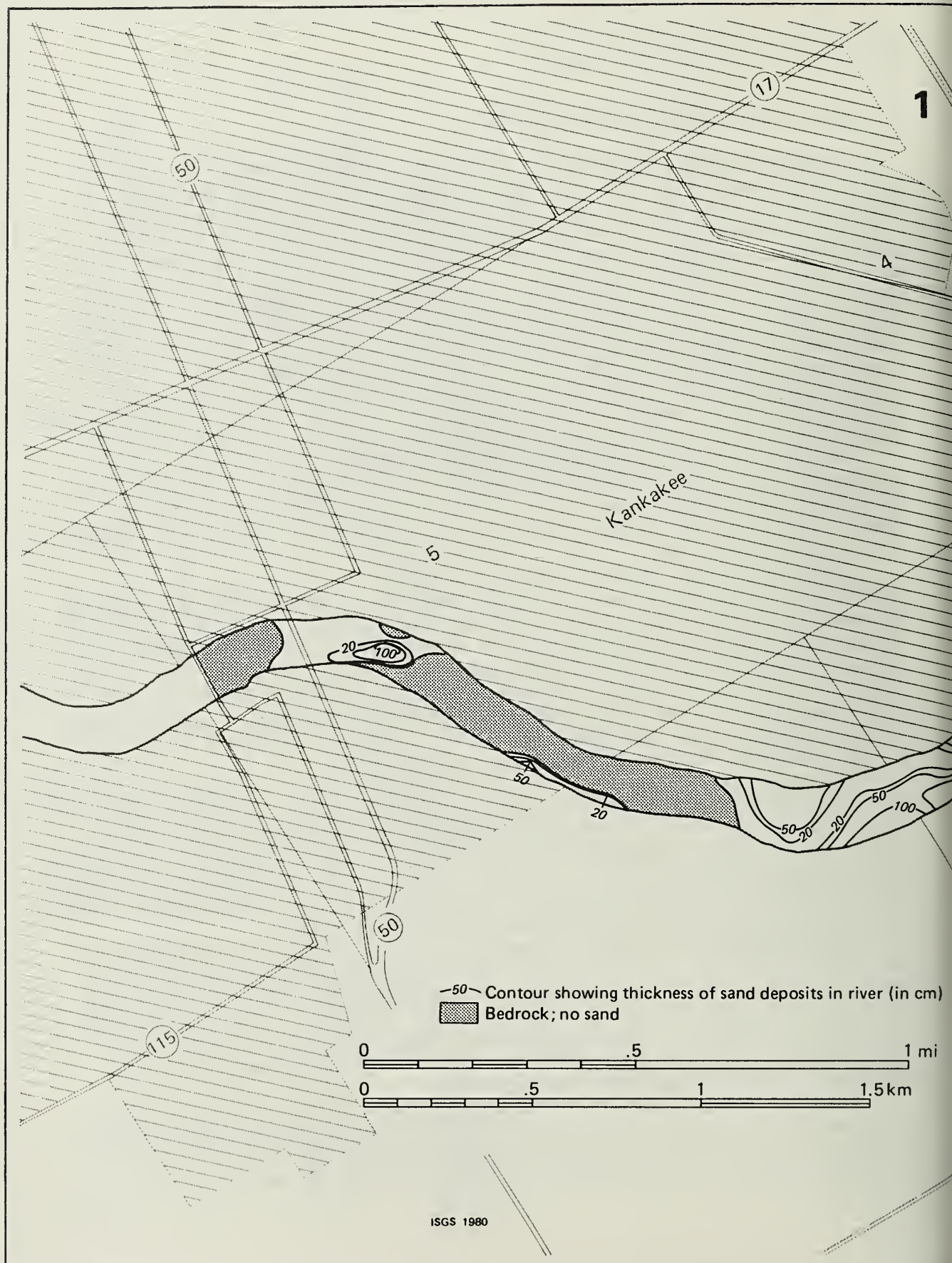


Figure 14. Map of thickness and distribution of sand deposits in the Kankakee River in Kankakee County, Illinois.

1a

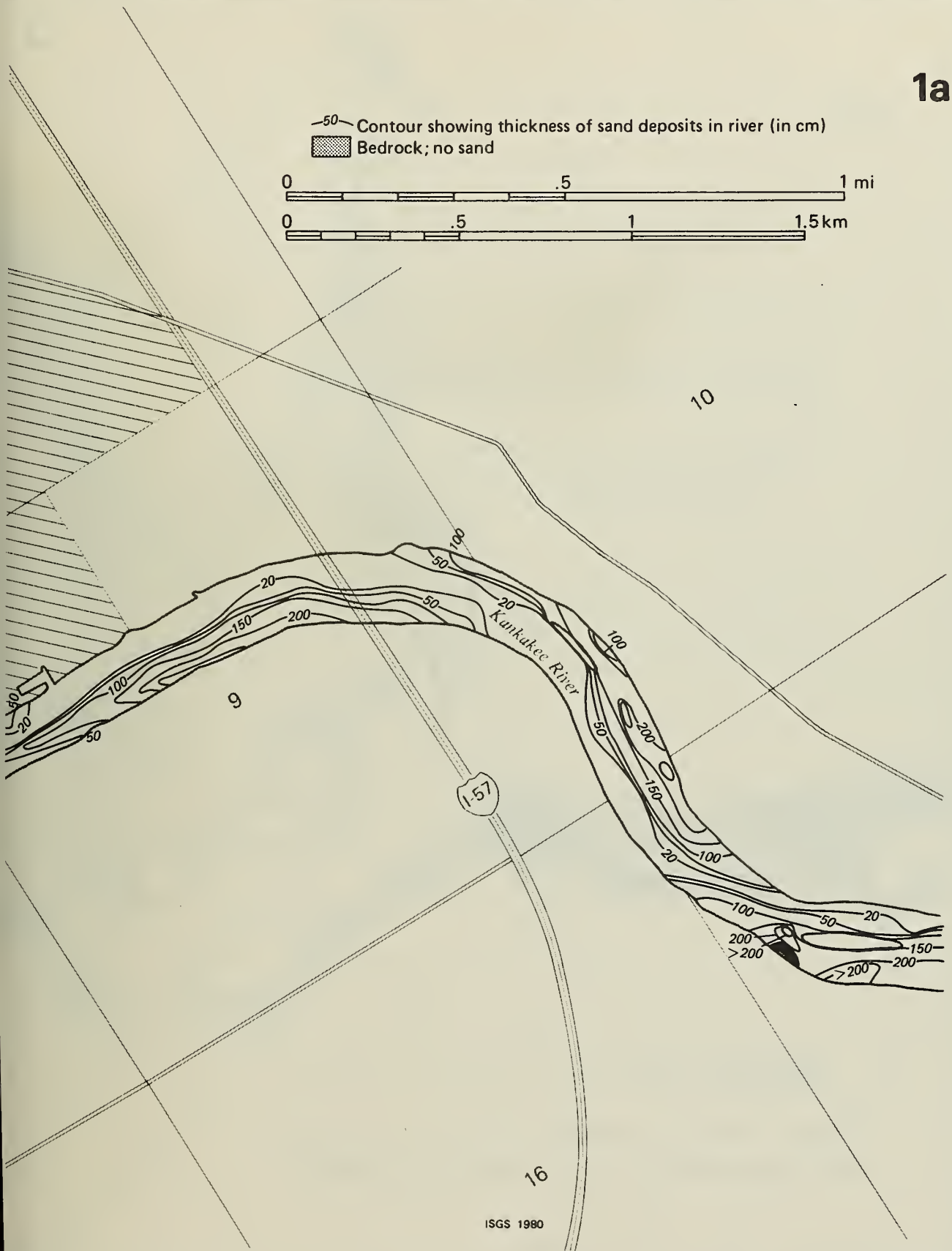
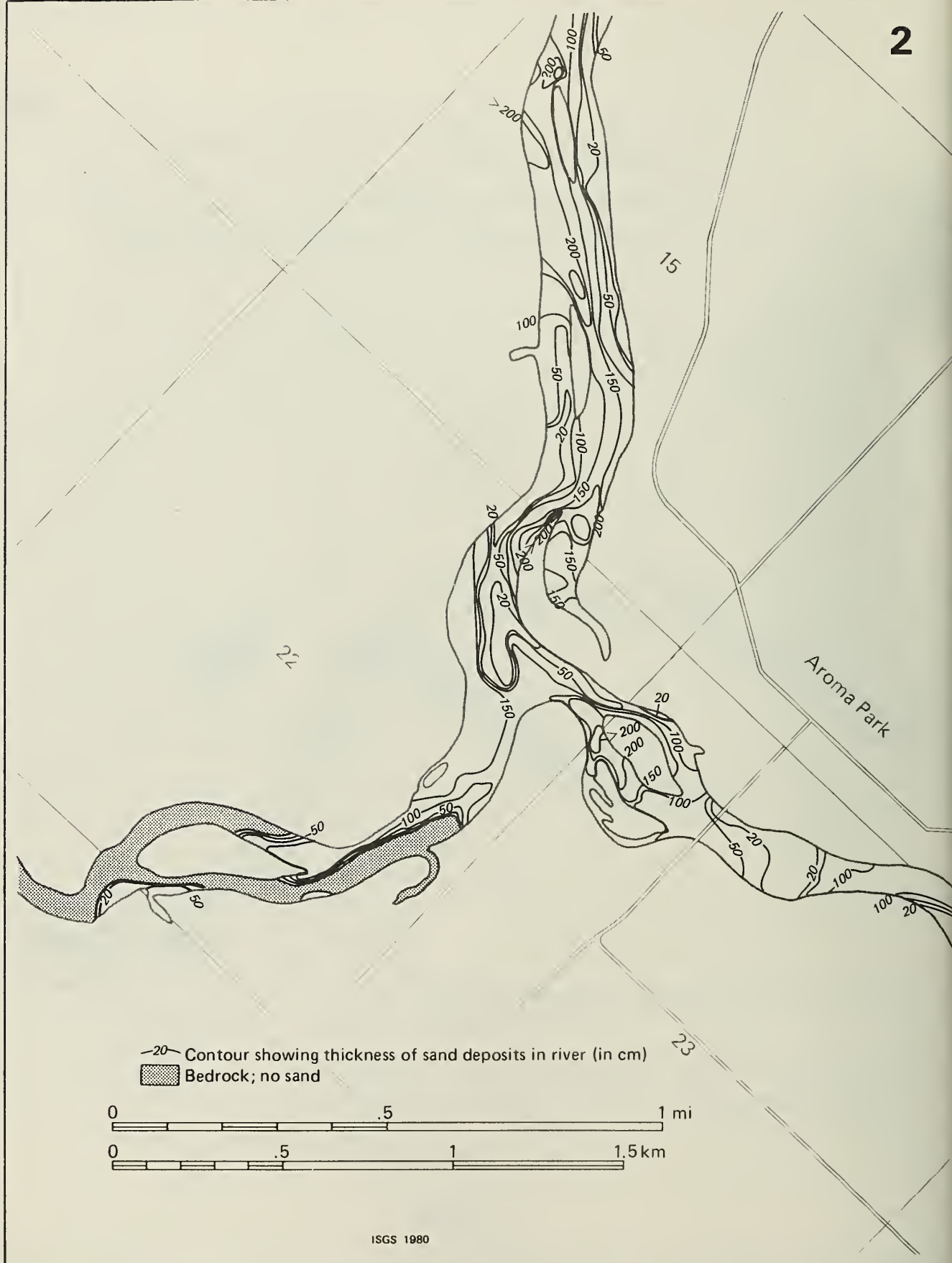


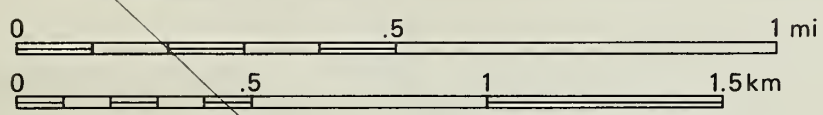
Figure 14. continued

Figure 14. *continued*

2a

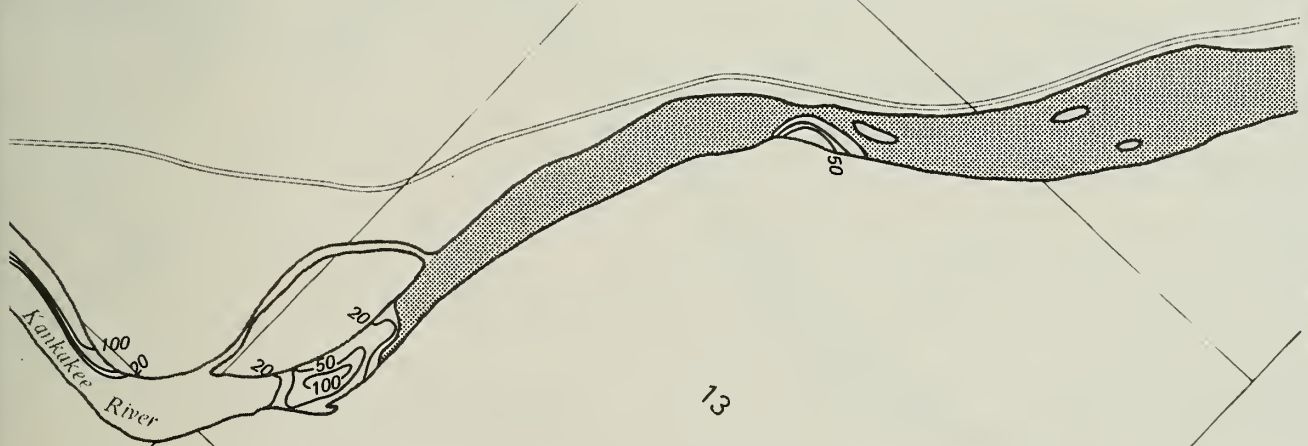
11

50 Contour showing thickness of sand deposits in river (in cm)
Bedrock; no sand



14

12



13

ISGS 1980

Figure 14. continued

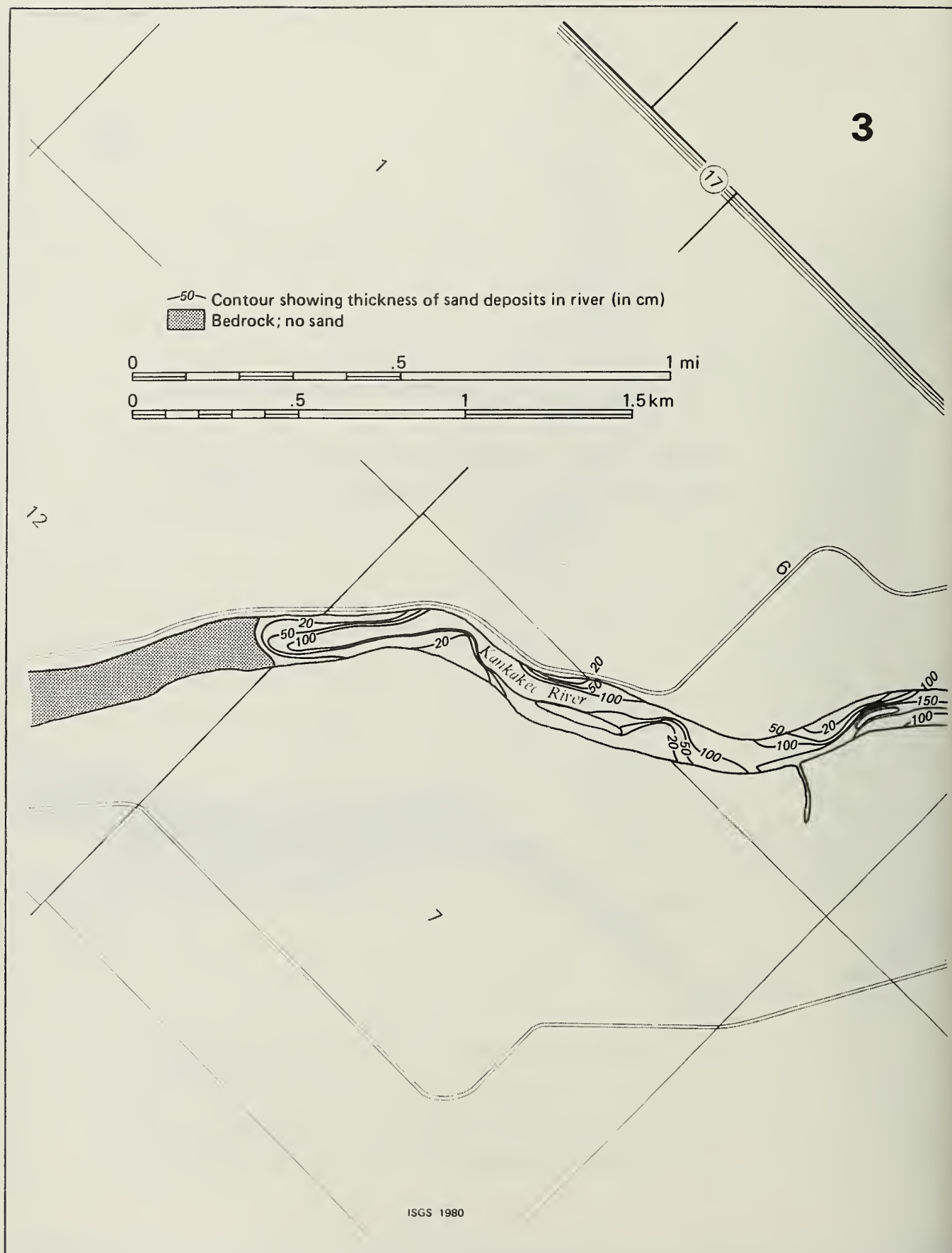
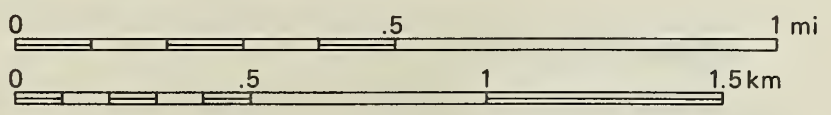


Figure 14. *continued*

37

3a

—20— Contour showing thickness of sand deposits in river (in cm)
 [hatched box] Bedrock; no sand



ISGS 1980

Figure 14. continued

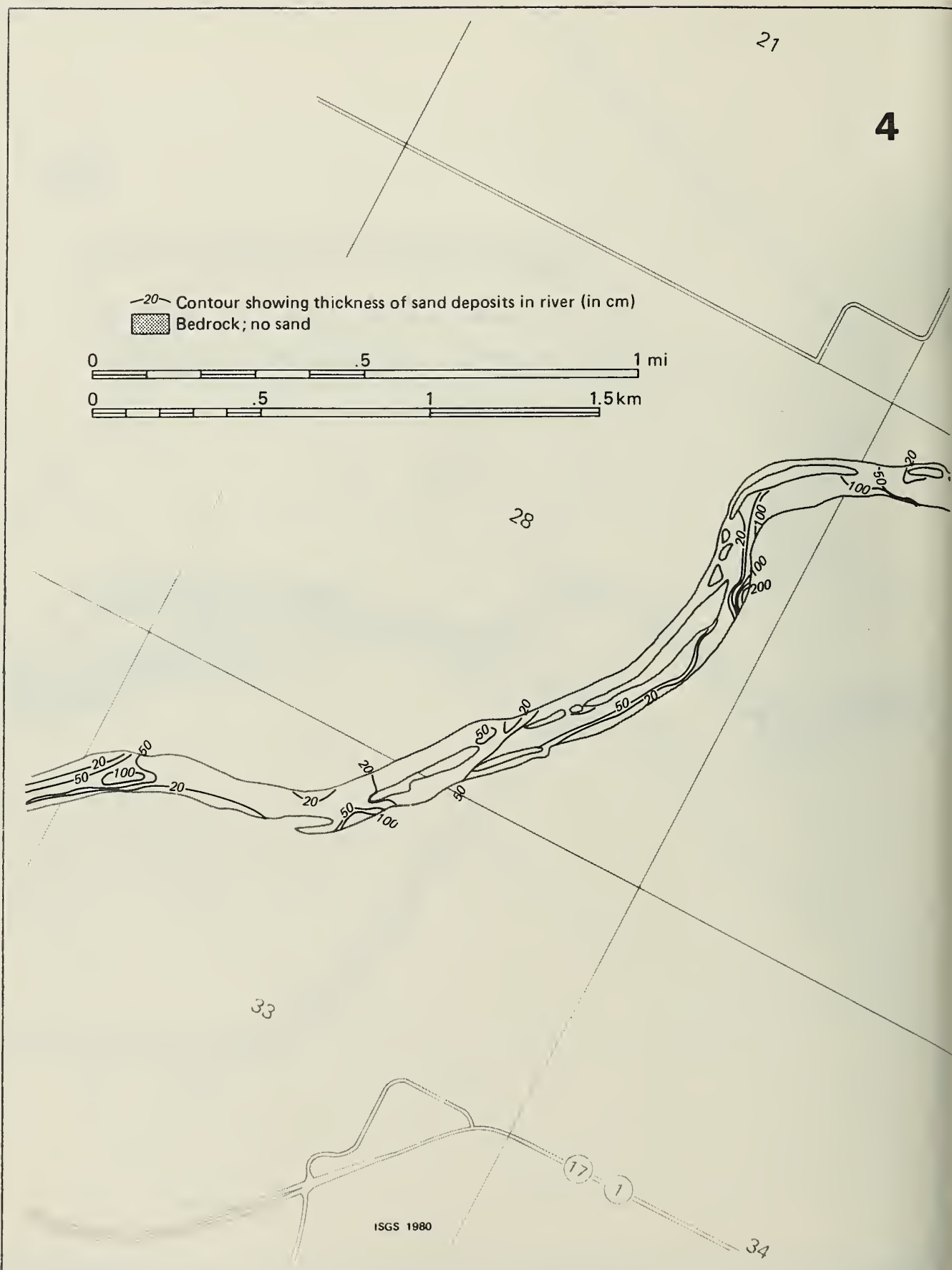


Figure 14. *continued*

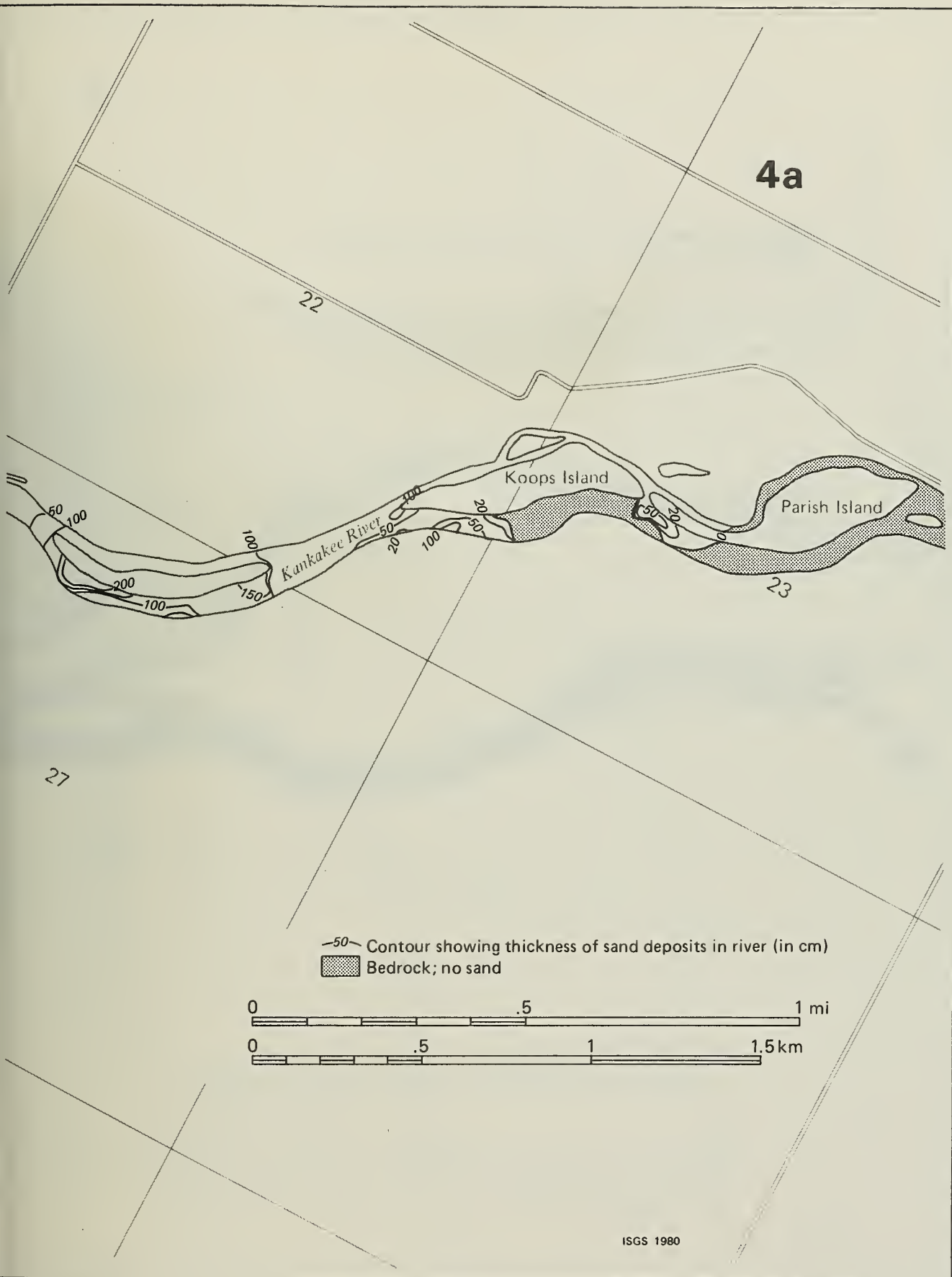


Figure 14. continued

5

1

17

—50— Contour showing thickness of sand deposits in river (in cm)
Bedrock; no sand

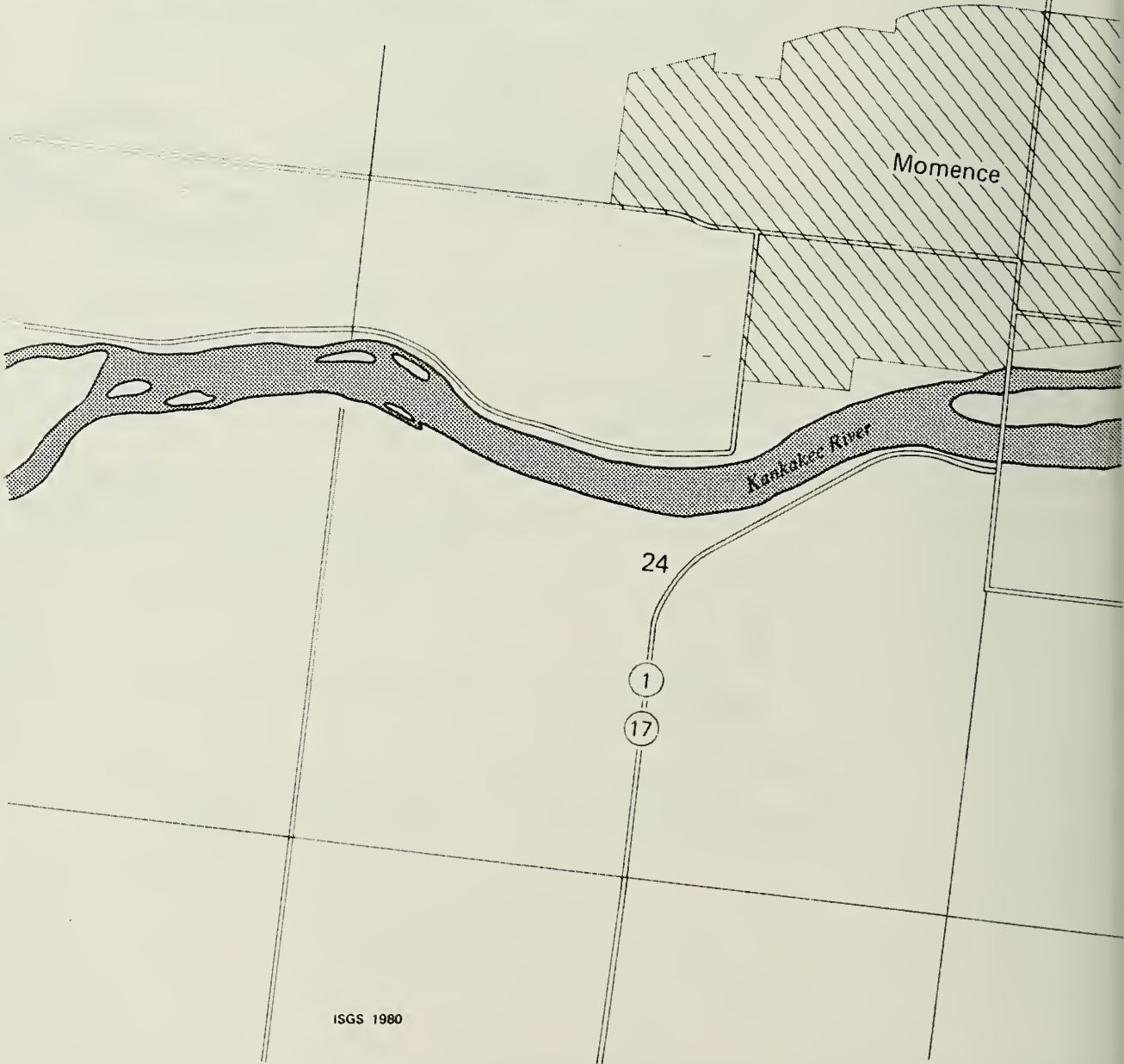
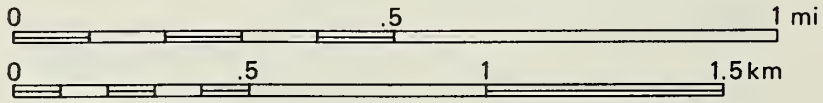
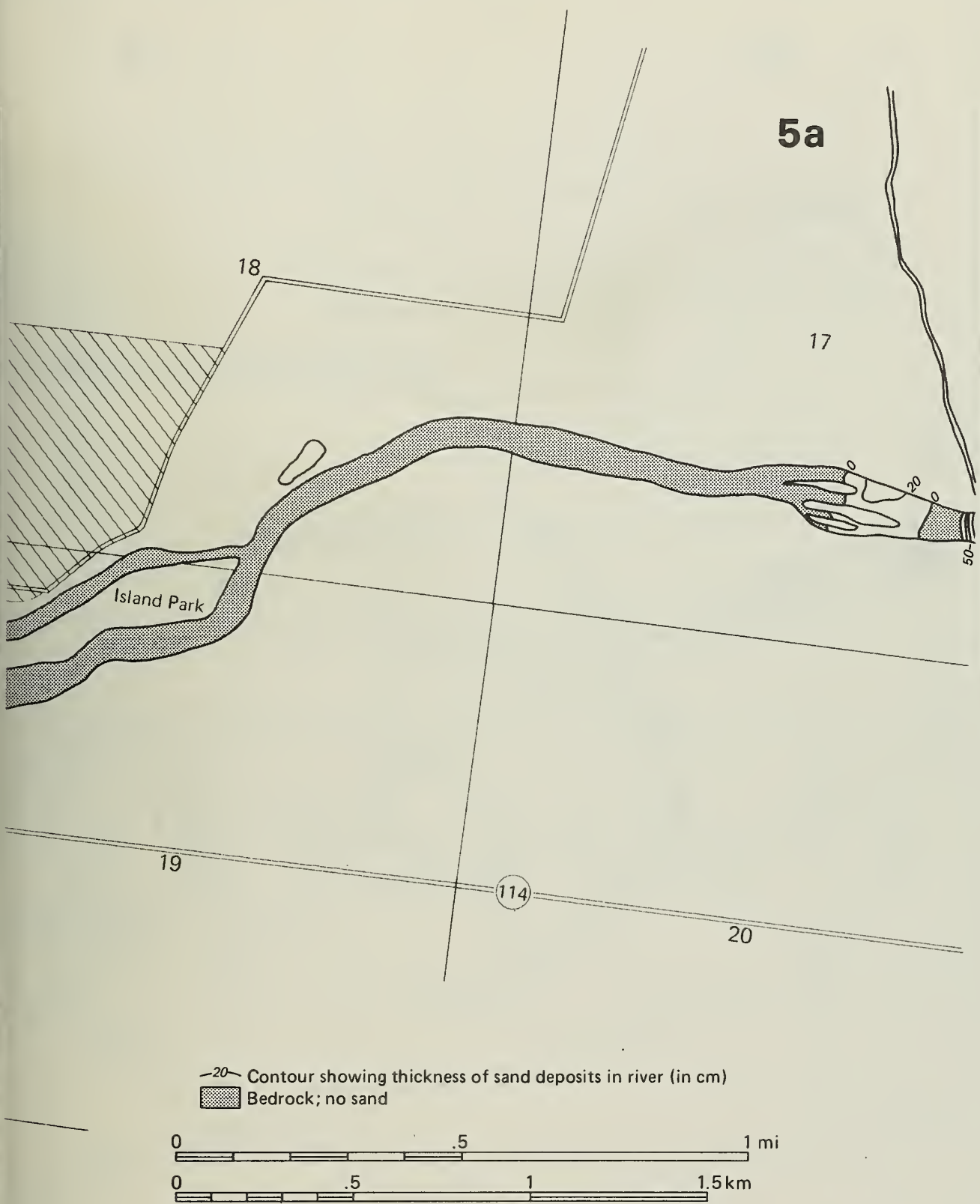


Figure 14. *continued*



ISGS 1980

Figure 14. continued

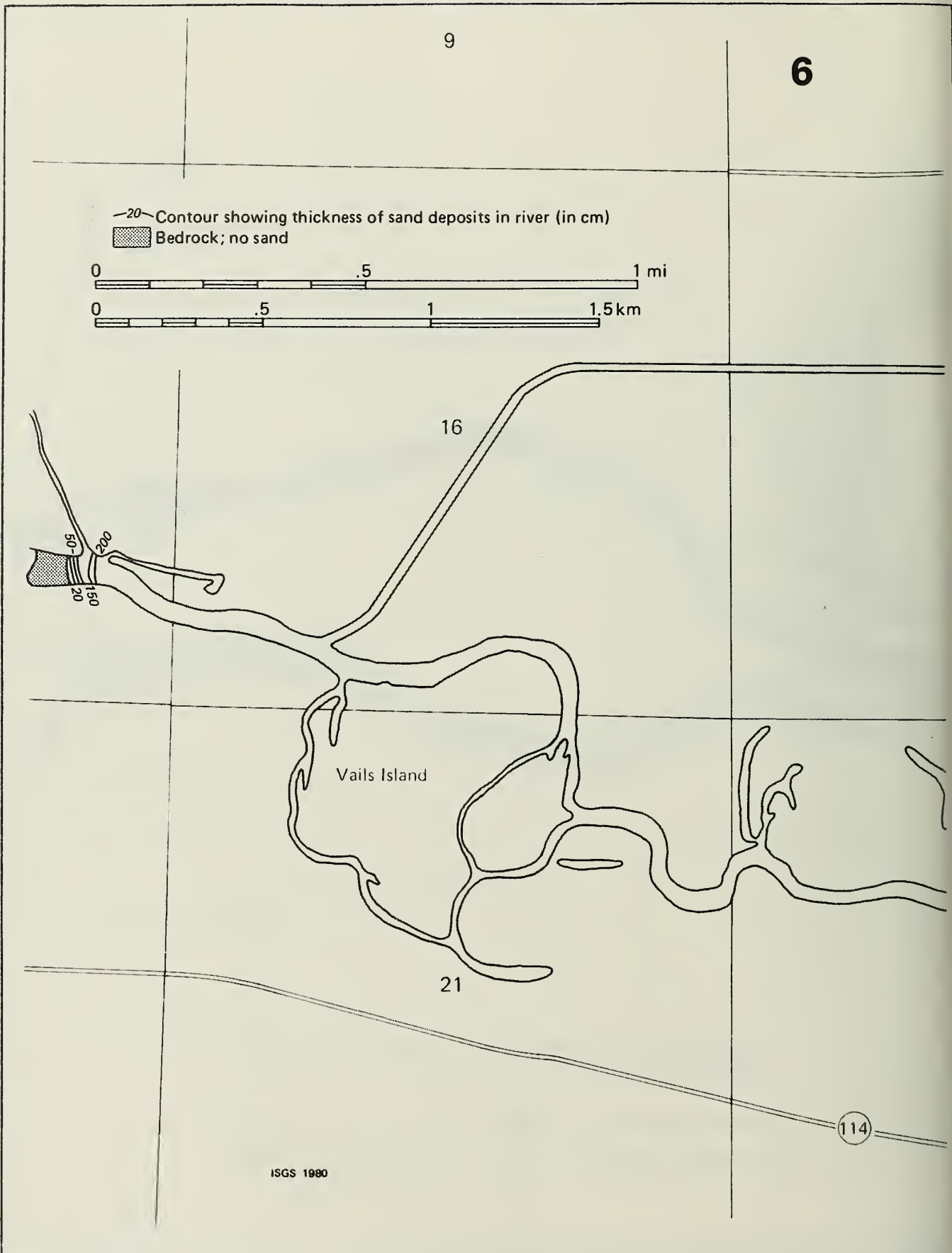


Figure 14. *continued*

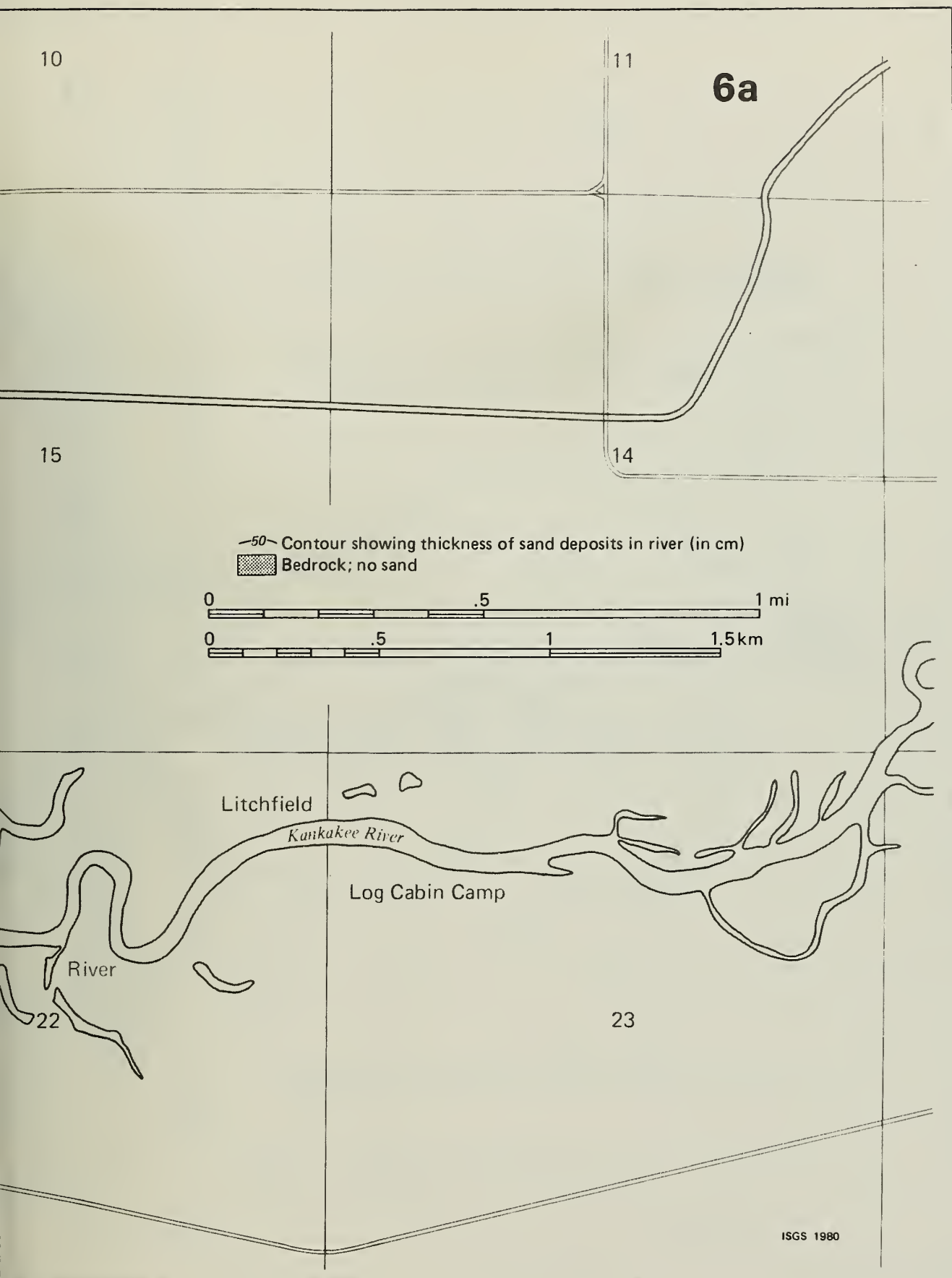
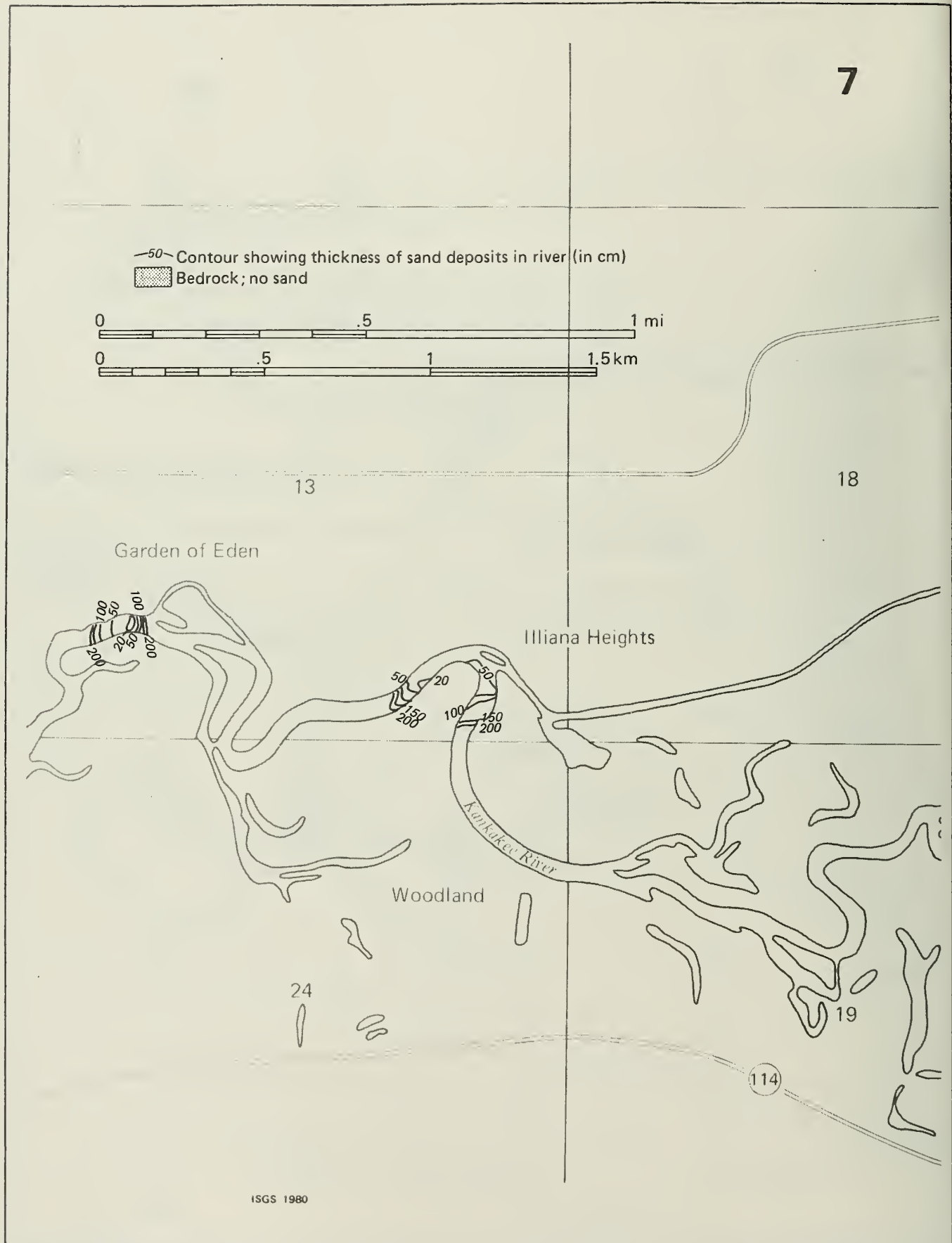


Figure 14. continued

Figure 14. *continued*

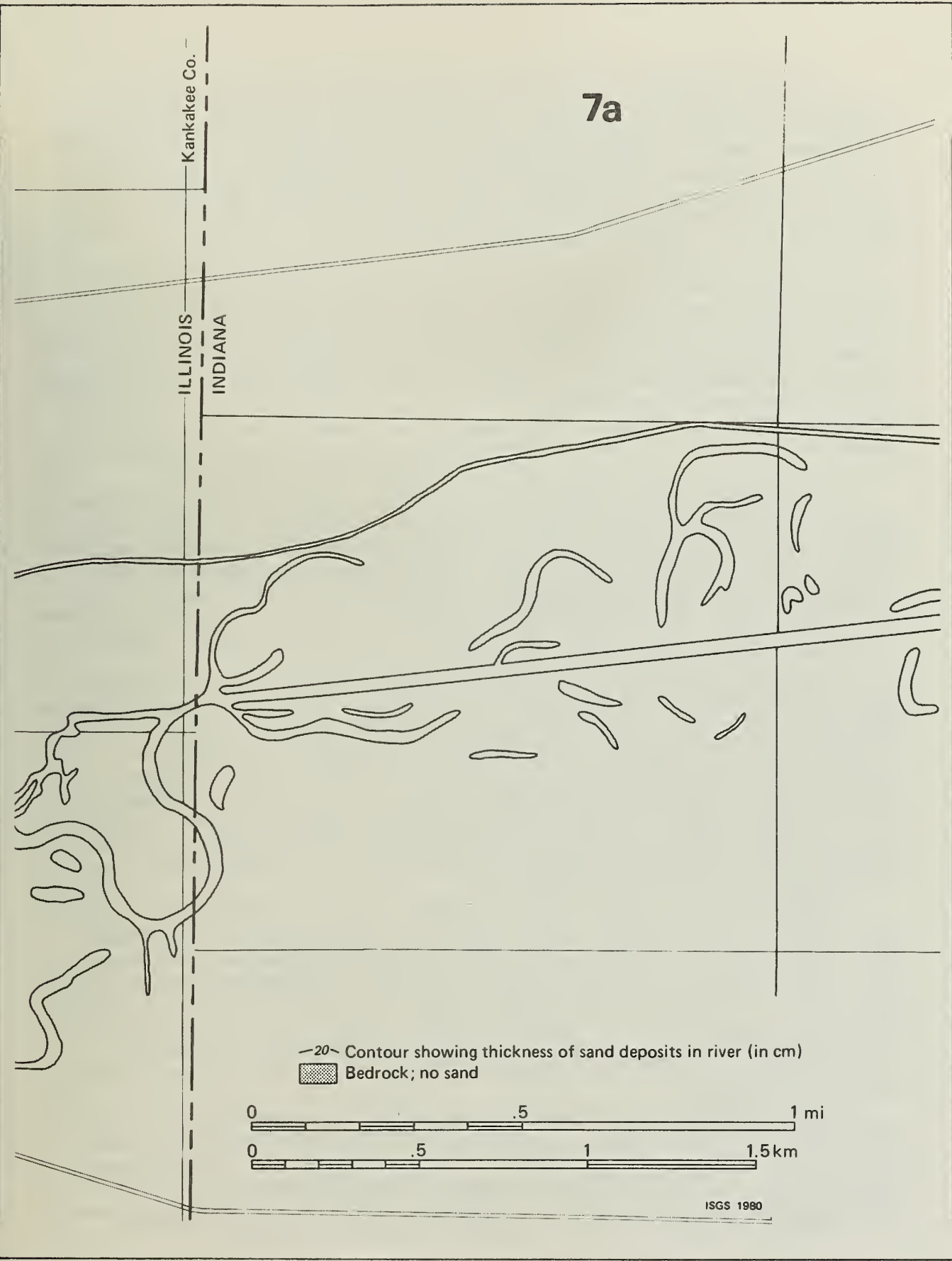


Figure 14. *concluded*

At the confluence of Trim Creek with the Kankakee River, about 1.5 miles east of Momence, the bedrock surface abruptly rises, as shown previously. About 250 feet east of the confluence, the sand was thicker than the probing depth, while at the confluence point bedrock is encountered at 110 cm, and about 250 feet west of the confluence point, there is no sand. From this point for about 3.5 miles downriver to the western edge of Parish Island, bedrock is at the surface. However, sand up to 10 cm thick may occur locally in depressions or pockets.

From Parish Island to about 1 mile upriver of the bridge at State Road 17, the river is characterized by sand bars interspersed by areas of thinner sand deposits over bedrock. Probes were made in cross sections spaced at 500- to 1,000-foot intervals to determine the linear extent and breadth of the sand bodies. The number of probes per cross section was primarily dependent upon the width of the river. The sand bars within this reach are between 70 and 200 cm thick. They are alongside Parish Island, Koops Island, Maple Island, Eagle Island, and numerous unnamed islands downriver from Eagle Island on the inside of meander bends. The sand between the bars is from less than 10 to about 80 or 90 cm thick.

For a 1-mile reach upriver of the bridge at State Road 17, the angularity of meander bends has caused the sand to be thicker on the outside than on the inside of the bends. The pronounced bend about 1,000 feet upriver of the bridge has less than 10 cm of sand on its inside, although 200 cm of sand occurs on the outside. Downriver of the highway bridge, a pronounced sand bar along the east bank of the river has a sand thickness more than 190 cm. Bedrock at the surface is found immediately downriver of the bar, where sand is 0 to 10 cm thick.

The next 1.5 miles of river is characterized by sand in a ridgelike deposit more than 100 cm thick (in one restricted locale the sand is greater than 210 cm thick) in the central portion of the channel. On both sides of the ridge, the thickness of sand decreases to about 10 cm; at its proximal end, sand thicknesses decrease abruptly as a bedrock ledge is encountered. The ledge then extends about 2 miles to a point about 1 mile upriver of the confluence of the Kankakee River with the Iroquois River. The only appreciable sand deposit within this bedrock reach is in a small area just upriver of where Spring Creek enters the Kankakee River. The thickness of sand here is 120 cm.

Between the confluence of Spring Creek with the Kankakee River and the highway bridge at Aroma Park, the sand is thicker along the northern bank than the southern bank. The Aroma Park ledge is encountered about 500 feet upriver from the Penn Central railroad bridge where the sand is less than 20 cm thick on its surface. Downriver from the highway bridge at Aroma Park, sand deposits once again increase to more than 100 cm thick. On the west side of the islands just upriver of the confluence of the Iroquois River with the Kankakee River, 295 cm of sand was probed without encountering bedrock.

A large volume of the thick sand deposits that accumulate near the confluence of the two rivers is diverted into the Iroquois River as back-water sedimentation. The thickness of sand decreases away from the mouth of the river. As much as 240 cm of sand is along the west bank of the Iroquois River near the point of confluence, while less than 10 cm of sand characterizes most of the upper reaches of the river.

From the confluence of the Kankakee and Iroquois Rivers to about 1 mile west of the Interstate 57 bridge, a distance of about 3 miles along the Kankakee River, a distinct bedrock channel meanders through the river bottom. The sand in the channel is consistently about 10 cm thick. Outside of the channel the sediment thickness increases to more than 200 cm and in restricted areas, more than 250 cm. In numerous locales these thick deposits are composed of silt and clay. This is the material that was cored with the Benthos open-tube gravity corer and analyzed for grain size and chemical constituents.

The sediment in the 1-mile reach of the Kankakee River, adjacent to the city of Kankakee upstream from the dam, is characterized by less than 10 cm of sand over bedrock. The only thicker deposits are opposite Cobb Park and just upriver from the State Highway 50 bridge where about 100 cm of sediment has accumulated.

CHEMICAL COMPOSITION OF SEDIMENT IN THE RIVER

Detailed chemical analyses were performed on 19 samples from three cores collected from Six Mile Pool in September 1978. Forty elements were studied on each of the 19 samples for a total of 760 chemical analyses. Core KR-138 was collected from the Iroquois River branch of the upper (eastern) end of the pool. Cores KR-134 and KR-143 were collected from the lower (western) end of the pool, just west of the Interstate Highway 57 bridge crossing. All of these locations are shown in figure 5. The chemical results are listed in table 1 and a comparative summary is provided in table 2.

Elsewhere in Illinois, chemical studies of cores of lake sediment have often been very useful in determining the sedimentation rate and the history of chemical changes in the watershed (Shimp and others, 1971; Collinson and Shimp, 1972; Dreher, Muchmore, and Stover, 1977; Kothandarmam and others, 1977; and Cahill, in press). If sediment cores of the proper length could be obtained, in almost every case the bases of the cores have been found to contain baseline or natural concentrations of trace metals; the top of the cores have been found to be enriched in the pollutants that have been introduced to the watershed in the nineteenth and twentieth centuries. The cores from the Six Mile Pool of the Kankakee River proved to be an exception.

The elemental concentrations of trace metals shown in table 2 are averages for the uppermost or most recently deposited sediment in the Kankakee River, Lake Paradise, Lake Michigan, Fox Chain of Lakes, Lake Du Quoin, and Upper Peoria Lake. The concentrations of As, Br, Cr, Cu, P_2O_5 , Sb, and Zn in the Kankakee River sediments are the lowest of any of the lakes listed, meaning that the Kankakee River sediment is relatively unpolluted with respect to these trace elements. The concentrations of some of these elements are plotted as a function of depth in the cores in figures 15, 16, and 17. Trace element concentrations are known to vary as a function of the percentage of fine-grained material and as a function of the concentration of organic carbon. In figures 15, 16, and 17, the trace element concentrations can be seen to vary in direct proportion to the percentages of clay-sized material. No other trends are apparent for the Kankakee River sediments. In each of the reports referenced in table 2,

TABLE 1. Chemical composition of cores KR-134, KR-138, and KR-143.

Geol. No.	Lab. No.	Depth interval (cm)	Al (%)	Br (ppm)	Ca (%)	Cl (%)	Fe (%)	P (%)	K (%)	Si (%)	Ti (%)	Mg (%)	Na (%)	S (%)	Li (ppm)	Cu (ppm)
Kankakee Co., IL																
NW SE NE Sec. 22																
T. 30N., R. 13W.																
138	R14197	0-5	4.89	2.0	2.25	.01	2.22	.04	1.95	31.23	.32	1.36	.51	.12	31	15
138	R14198	10-15	5.00	4.8	2.66	.01	3.20	.06	2.39	27.02	.45	1.64	.41	.11	49	22
138	R14199	20-25	6.44	2.8	2.81	.01	3.10	.08	2.42	26.93	.46	1.59	.42	.10	47	22
138	R14200	30-35	6.55	3.7	2.15	.01	3.16	.08	2.38	27.42	.46	1.51	.41	.09	44	22
138	R14201	40-45	6.73	2.6	2.58	.01	3.56	.06	2.57	26.31	.43	1.49	.36	.08	51	24
138	R14202	53-55	3.42	2.4	1.55	.01	1.31	.02	1.49	37.67	.18	.96	.50	.09	18	11
138	R14203	60-65	6.67	4.4	1.98	.01	3.19	.07	2.40	27.22	.45	1.28	.39	.09	46	23
Kankakee Co., IL																
SW SW NE Sec. 22																
T. 30N., R. 13W.																
143	R14204	0-5	2.69	1.8	1.47	.01	1.04	.02	1.39	38.20	.13	.54	.61	.22	11	8.5
143	R14205	15-20	6.91	3.6	2.28	.01	3.88	.08	2.43	26.31	.46	1.30	.34	.15	50	29
143	R14206	30-35	6.91	4.3	1.65	.01	3.58	.08	2.32	26.90	.47	1.17	.39	.12	48	26
143	R14207	40-45	7.34	5.5	1.70	.01	4.00	.09	2.52	25.56	.47	1.41	.28	.10	58	29
143	R14208	55-60	6.72	5.2	2.27	.01	3.71	.09	2.33	26.43	.46	1.39	.36	.13	47	27
Kankakee Co., IL																
NE SE NW Sec. 22																
T. 30N., R. 13W.																
134	R14209	0-5	3.12	3.9	1.76	.01	1.69	.07	1.32	36.26	.15	.44	.39	.20	14	16
134	R14210	8-13	2.85	2.7	1.18	.02	1.51	.04	1.35	37.78	.15	.67	.45	.20	1.5	12
134	R14211	13-18	1.84	2	.74	.02	.61	.01	.94	42.83	.06	.22	.39	.11	6.4	4.8
134	R14212	18-20	4.08	4.7	1.63	.01	2.31	.05	1.48	34.08	.23	.81	.30	.19	24	18
134	R14213	20-28	1.57	2	.73	.01	.58	.03	.88	43.13	.06	.43	.25	.06	5.5	4.8
134	R14214	31-36	7.23	5.6	1.73	.01	4.09	.09	2.44	25.94	.45	1.48	.28	.11	54	27
134	R14215	41-46	5.98	2.5	2.17	.01	3.56	.07	2.19	27.54	.43	1.43	.29	.20	43	22

TABLE 1. *Continued*

Geol. No.	Lab. No.	Depth interval (cm)	La (ppm)	Lu (ppm)	Rb (ppm)	Cs (ppm)	Sc (ppm)	Sm (ppm)	Tb (ppm)	Ta (ppm)	Yb (ppm)	Th (ppm)	W (ppm)	Eu (ppm)	Sb (ppm)
Kankakee Co., IL															
NW SE NE Sec. 22,															
T. 30N., R. 13W.															
138	R14197	0-5	29	.5	100	4.2	10	4.8	.6	.8	2.2	9	.7	.9	.5
138	R14198	10-15	37	.5	120	6.0	14	6.5	.9	1.1	2.4	12	1.4	1.2	.7
138	R14199	20-25	38	.7	115	6.0	14	6.6	.8	1.0	2.7	12	1	1.1	.5
138	R14200	30-35	40	.4	120	5.8	14	6.6	.8	1.1	2.7	12	1	1.2	.7
138	R14201	40-45	40	.6	130	6.2	15	6.8	1.0	.9	3.2	13	1.5	1.2	.7
138	R14202	53-55	17	.3	65	2.5	6	2.9	.4	.5	1.6	5	1	.6	.4
138	R14203	60-65	38	.5	120	7.1	14	6.4	.8	1.0	3.0	13	1	1.1	.7
Kankakee Co., IL															
SW SE NE Sec. 22,															
T. 30N., R. 13W.															
143	R14204	0-5	16	.3	50	1.3	4	2.6	.3	.3	1.2	4	1	.5	.3
143	R14205	15-20	40	.6	126	6.4	15	6.5	1.0	1.2	3.0	13	1.6	1.2	.8
143	R14206	30-35	40	.6	127	7.0	4	6.9	1.1	1.2	3.4	14	1.5	1.4	.8
143	R14207	40-45	43	.7	154	8.2	18	6.8	1.1	1.3	3.6	16	2	1.3	.8
143	R14208	55-60	42	.5	135	7.0	15	6.5	.8	1.1	3.4	14	1.6	1.3	.7
Kankakee Co., IL															
NE SE NW Sec. 22,															
T. 30N., R. 13W.															
134	R14209	0-5	16	.2	57	2.0	5	2.4	.4	.4	1.5	5	.5	.5	.4
134	R14210	8-13	17	.4	58	2.5	5	2.7	.4	.4	1.3	6	1	.5	.5
134	R14211	13-18	9	.1	34	.8	2	1.3	.3	.1	.7	2	2	.3	.3
134	R14212	18-20	24	.3	55	2.5	6	3.8	.5	.5	1.5	5	1.2	.7	.5
134	R14213	20-28	8	.2	33	.6	2	1.2	.3	.2	.6	2	1	.3	.2
134	R14214	31-36	44	.5	134	7.0	15	6.3	.8	1.2	2.9	14	2	1.2	.7
134	R14215	41-46	31	.5	103	5.5	12	4.8	.9	1.1	2.8	12	1	1.0	.6

TABLE 1. *Concluded*

Geol. No.	Lab. No.	Depth interval (cm)	Co (ppm)	Ni (ppm)	Cr (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	As (ppm)	Ga (ppm)	U (ppm)	Ba (ppm)	Ce (ppm)	Hf (ppm)
Kankakee Co., IL															
NW SE NE Sec. 22,															
T. 30N., R. 13W.															
138	R14197	0-5	13	36	50	21	70	73	4	5.2	12	3	650	45	7
138	R14198	10-15	17	36	61	19	70	110	4	8.1	15	3	670	56	5
138	R14199	20-25	17	36	62	19	70	100	4	7.7	18	2.5	650	56	6
138	R14200	30-35	16	36	64	20	70	100	4	8.2	17	3	675	58	6
138	R14201	40-45	18	36	70	18	70	110	4	8.3	19	2.5	675	59	4
138	R14202	53-55	8	36	25	18	70	39	4	3.9	10	2.5	480	27	4
138	R14203	60-65	16	36	64	13	70	110	4	8.5	18	3	760	58	4
Kankakee Co., IL															
SW SW NE Sec. 22,															
T. 30N., R. 13W.															
143	R14204	0-5	7	36	22	14	70	55	4	4.2	7	2	650	24	5
143	R14205	15-20	17	36	68	12	70	160	4	13	16	3	800	60	6
143	R14206	30-35	16	36	70	13	70	130	4	11	19	3	740	61	7
143	R14207	40-45	18	36	82	8	70	140	4	13	20	4	810	64	7
143	R14208	55-60	18	36	70	10	70	130	4	12	18	3	760	61	8
Kankakee Co., IL															
NE SE NW Sec. 22,															
T. 30N., R. 13W.															
134	R14209	0-5	8	36	30	9	70	66	4	8.1	7	2	550	23	4
134	R14210	8-13	9	36	30	13	70	68	4	9.4	6	2.5	550	27	4
134	R14211	13-18	4	36	13	12	70	26	4	2.5	4	2.3	400	12	3
134	R14212	18-20	9	36	28	13	70	100	4	10	11	2.5	430	20	3
134	R14213	20-28	4	36	8	13	70	30	4	2.5	5	2.4	330	17	3
134	R14214	31-36	16	36	71	13	70	140	4	13	19	3	860	64	9
134	R14215	41-46	16	36	60	14	70	110	4	10	13	2.7	570	49	6

TABLE 2. Comparison of elemental concentration in surface sediments of the Six Mile Pool of the Kankakee River with other Illinois lakes

Element	Kankakee River	Lake Paradise ¹	Lake Michigan ²	Fox Chain of Lakes ³	Lake Du Quoin ⁴	Upper Peoria Lake ⁵
As (ppm)	5.8	8.6	10.5	---	---	11
Br (ppm)	2.6	7	33	---	---	<20
Cd (ppm)	<4	<.8	0.9	<.6	---	8
Cr (ppm)	34	87	46	---	63	148
Cu (ppm)	13	24	22	21	304	58
Hg (ppm)	---	---	0.11	0.22	---	0.23
Ni (ppm)	<36	49	24	26	32	51
P ₂ O ₅ (%)	.04	0.22	0.16	0.22	0.23	0.70
Pb (ppm)	<70	<5	40	44	---	140
Sb (ppm)	0.4	1.0	1.1	---	---	---
Zn (ppm)	65	94	97	90	192	420
TOC (%)	---	2.9	2.0	5.5	2.4	2.4

¹ Work in progress at Illinois State Geological Survey.

² Cahill (in press)

³ Kothandarman et al. (1977).

⁴ Dreher, Muchmore, and Stover (1977).

⁵ Collinson and Shimp (1972).

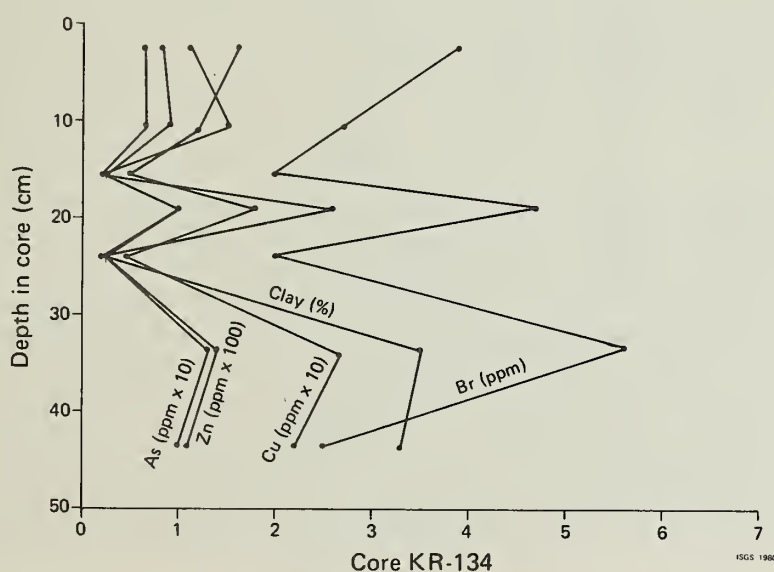


Figure 15. Selected chemical constituents in core KR-134.

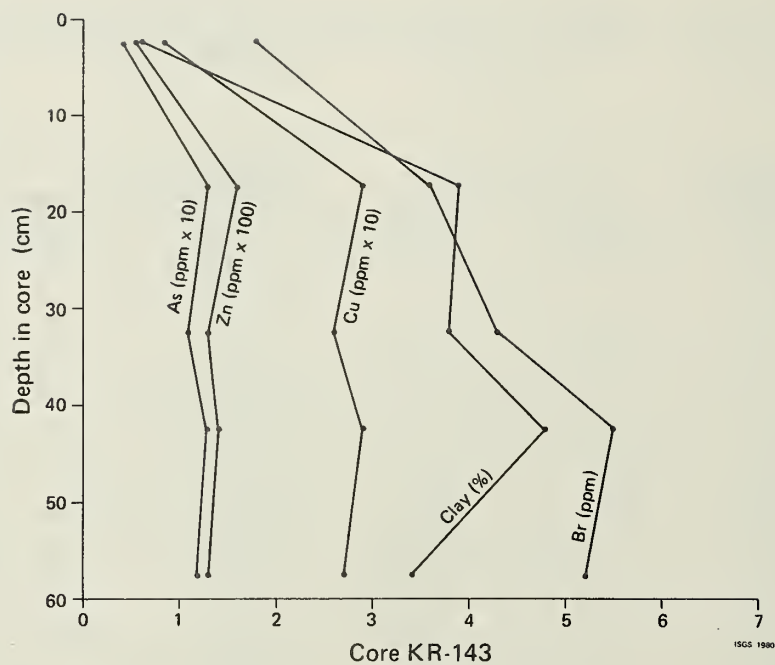


Figure 16. Selected chemical constituents in core KR-143

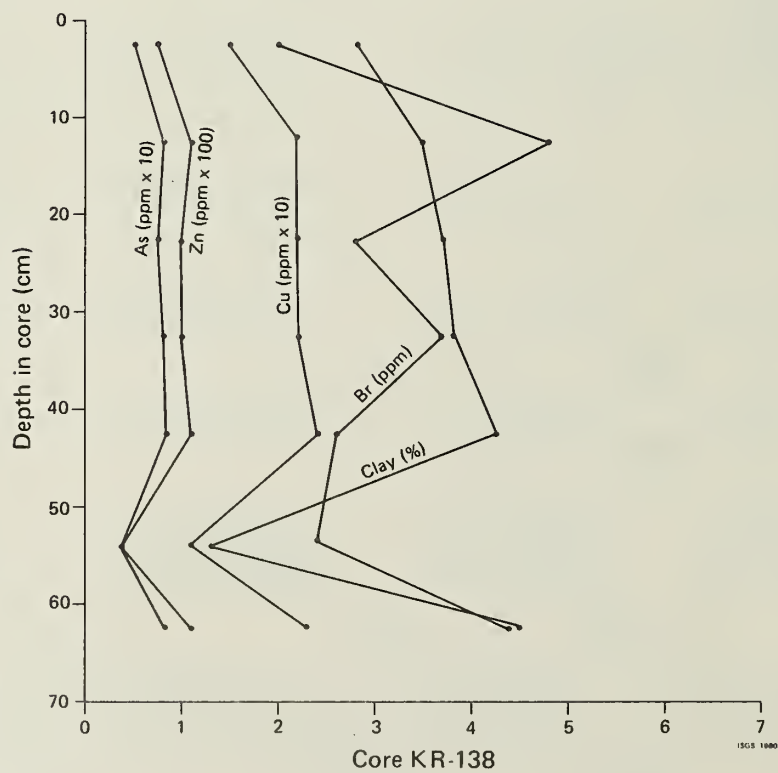


Figure 17. Selected chemical constituents in core KR-138.

the concentrations for most of these trace metals increased markedly near the top of the cores. Those increases have been interpreted as representing increased concentrations of those pollutants in the watersheds in recent years. As noted earlier, the Kankakee River is an exception.

DISCUSSION OF SEDIMENTATION

Theoretically, there are three general interpretations that could be used to explain the uniform, baseline chemical composition of this sediment.

1. All of the sediment sampled in these three cores could be geologically old.
2. These cores could represent both geologically old sediment (base of the cores) and geologically young sediment (top of the cores) with the chemical composition of the sediment remaining constant through time.
3. These cores could be geologically recent sediment that is relatively unpolluted.

When the chemical results are combined with our knowledge of sediment movement in this river, the first two interpretations can be eliminated. The third interpretation is the one favored.

It is well known that rivers tend to erode their beds during the times of high flow and then redeposit sediment during times of low flow. This phenomenon was measured by Bhowmik and others (in press) at the bridge over the Kankakee River at the Illinois-Indiana state line (fig. 2). They measured the depth of the river channel on numerous occasions during a 1-year cycle and observed a considerable erosion of the bed during the spring floods of 1979 and a substantial deposition of sediment in the channel during the summer of 1979. The deposition of sand was especially striking and well documented by the repeated measurements of the topography of a massive sand bar that crossed from Indiana to Illinois under that bridge during the summer of 1979. The details of those measurements are reported by Bhowmik and others (in press). The magnitude of changes in elevation of the river bed was considerably greater than the total lengths of the cores analyzed chemically and reported here.

This same phenomenon of erosion of bed materials, downstream transport of sediment, and redeposition can be illustrated from another set of observations of the river, observations made just west (downstream) of the Interstate 57 bridge over Six Mile Pool. The cores analyzed chemically were collected in September 1978 and consisted of silty clay sediment with some sand (cores KR-138 and KR-143) and silty clay interbedded with layers of medium sand (core KR-134). This is all material that can be easily transported by the Kankakee River. It should be noted also that these three cores were not typical of the Kankakee in that they are finer grained than most sediment residing in the river. This was an unfortunate, but necessary, bias because the trace elements being studied are not adsorbed on sand. Most of the sediment in the river is medium-grained sand.

Core KR-134 (fig. 18) consisted of the following material:

Depth (cm)	Material
0-1	Sand, very dark gray 5 Y 3/1, fine to medium
1-8	Sand, very dark gray 5 Y 3/1, fine to medium, silty, contains wood fragments
8-13	Silt, black 5 Y 2/1, sandy with some clay
13-18	Sand, very dark gray 5 Y 3/1, medium to coarse, contains wood fragments
18-20	Silt, black 5 Y 2.5/1, clayey, sandy, faint bedding, contains wood fragments.
20-28	Sand, black 5 Y 3/1, medium
28-31	Sand and silt intermixed, faint bedding
31-50	Silt, black 5 Y 3/1, clayey with a little sand, faint bedding, gas bubbles

This core was collected in September 1978, was analyzed chemically, and was interpreted as containing three fining-upward sequences of sediment. The term "fining upward" means a cycle of sediment beginning at the base with coarse sediment and becoming progressively finer in grain size upward within the cycle. In this core the interval 0 to 8 cm is the lower half of a cycle, the intervals 8 to 18 and 18 to 31 cm are full cycles, and interval 31 to 50 cm is the top half of a cycle. Each of these cycles is interpreted as representing one depositional sequence, for example, the deposits of one flood cycle. The sequence commonly includes such events as erosion of the river bed during the high spring-time flow periods of the flood, deposition of coarse sediment (sand) during the later portion of the flood, and finally deposition of fine-grained sediment (silt) during the summer-time periods of low flow. In this example, the 13 to 18 cm depth interval is interpreted as the sand deposited early in the cycle and the 8 to 13 cm depth interval is interpreted as the silt deposited later in the same year. Although we do not know the exact dates of the deposition of these cycles, it would be reasonable to assume that they could be the deposits of 1976, 1977, and 1978.

Because the chemical analyses showed all of the sediment to be of uniform, baseline composition and because major floods occurred on the Kankakee River in the early spring of 1979, we resampled these coring locations in June 1979. Cores KR-168 and KR-169 were collected from the same locations as the 1978 cores KR-134 and KR-143 (fig. 5). Major changes in sediment thickness and grain size occurred between the 1978 and 1979 sampling. Core KR-168 encountered only 20 cm of sand overlying bedrock. Core KR-169 is illustrated in a photograph in figure 19 and consisted of the following material:

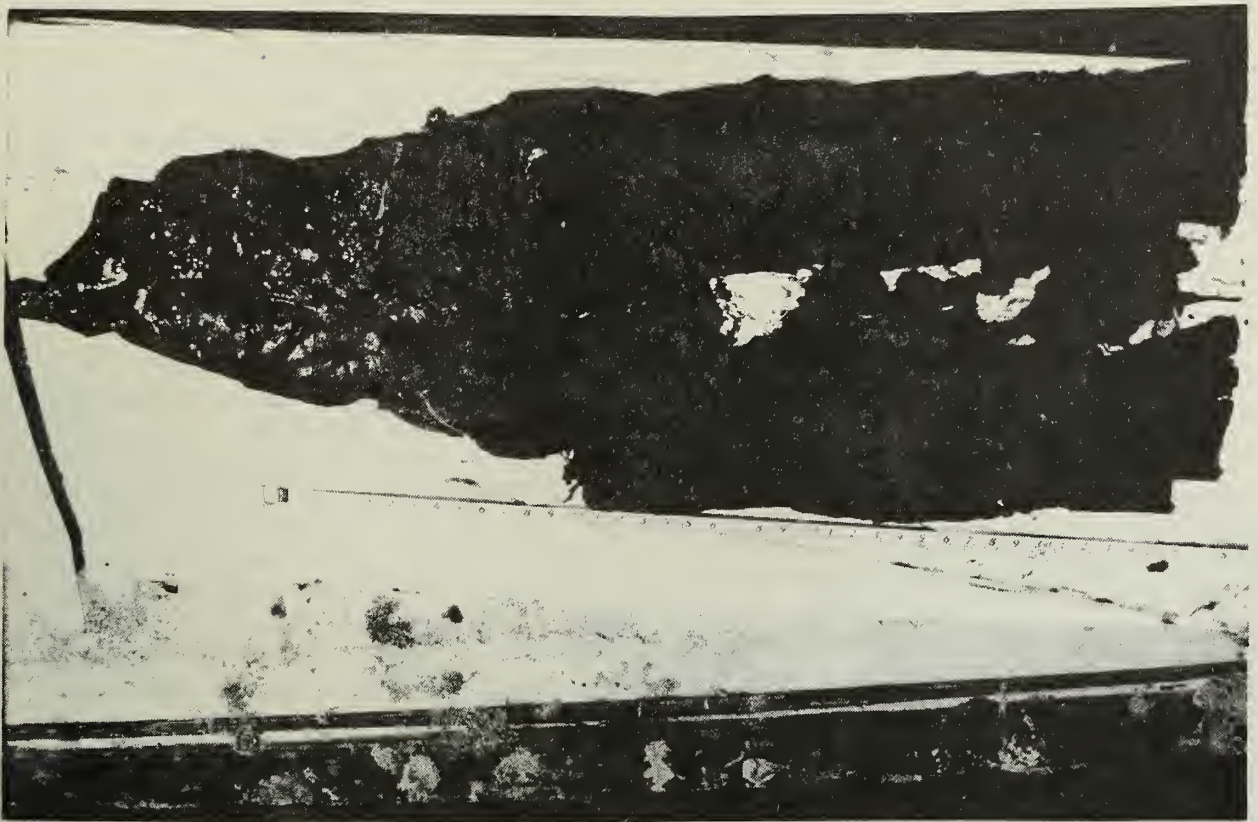


Figure 18. Photograph of core KR-134.

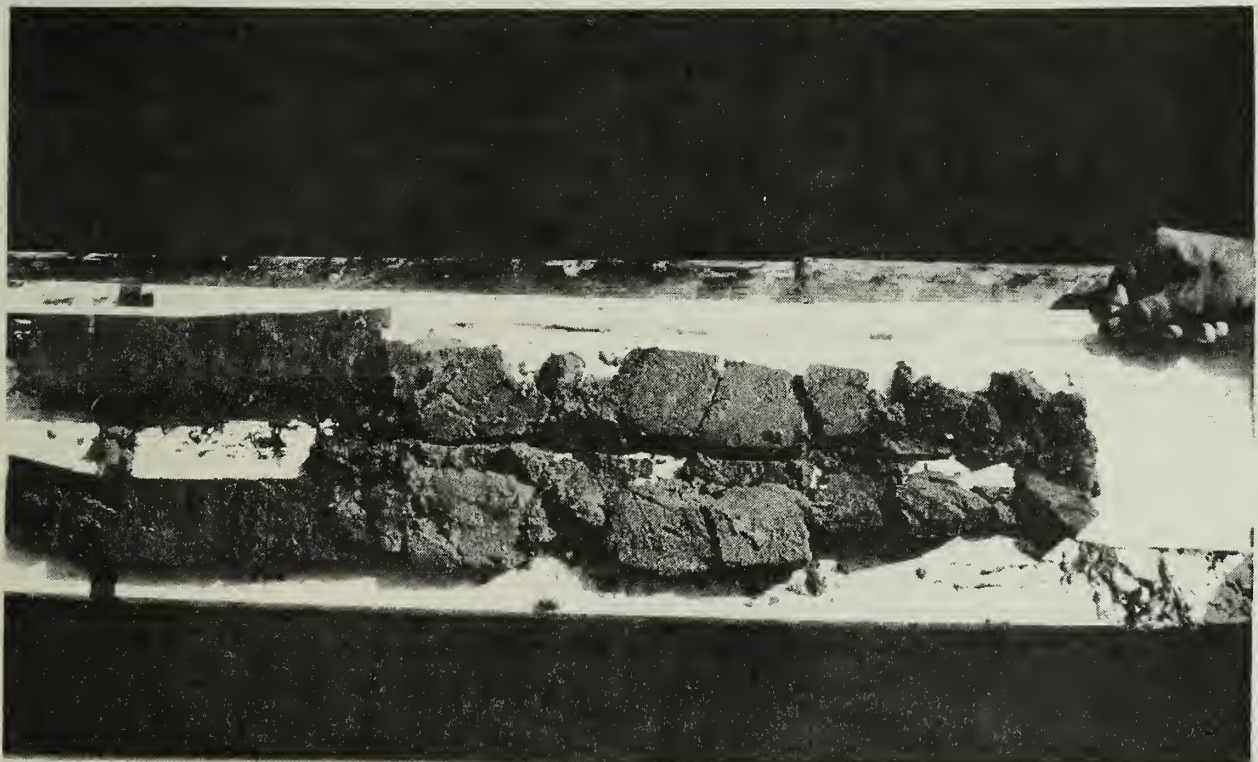


Figure 19. Photograph of core KR-169.

Depth (cm)	Material
0-47	Sand, light olive brown 2.5 Y 5/4, fine to medium, massive
47-54	Sand, as above, grading downward to silty clay, black 5 Y 2/2
54-75	Sand, very dark grayish brown 2.5 Y 3/2, fine to medium, grading downward to silty clay, black 5 Y 2/2

The interpretation is that most of the sediment sampled by the cores collected in 1978 was eroded by the spring 1979 floods. In its place was this new deposit of sand, 47 cm thick, in Core KR-169. Unfortunately, we did not survey the exact depth of the river at each of these sampling locations, but it is obvious that the river was not 47 cm shallower in 1979. The conclusion is that the river erodes substantial quantities of sediment during the flood periods and then redeposits sediment later in the same year. This means that the material analyzed chemically was probably all of very recent origin.

RIVER MORPHOLOGY

The Kankakee River has a total length of 150 miles, 59 of which are in Illinois. The river flows from the northeast to the southwest until it joins with the Iroquois River near Aroma Park, from which the Kankakee River flows toward the northwest to its confluence point with the Des Plaines River near Wilmington where those two rivers become the Illinois.

The morphology of the present-day Kankakee River in Indiana is due to channelization and dredging over its entire length from South Bend, Indiana, to the Indiana-Illinois state line. The channelization was completed about 1918. Old meander bends were cut off as a nearly straight channel was constructed through the area previously referred to as the "Grand Marsh." Recent surveillance of the Indiana portion of the Kankakee River revealed that river morphology has remained essentially unchanged since the cessation of dredging activities. It does not appear that the river has started to meander.

In Illinois, the Kankakee River flows as a naturally meandering stream. Between the state line and Momence, an area commonly called the "Momence Wetlands," the Kankakee River flows over thick sand deposits and resembles the river in Indiana prior to dredging—numerous and angular meander bends and a relatively narrow channel. Between Momence and Kankakee, the Kankakee River, for the most part, flows on bedrock; therefore meandering morphology is less distinct, but natural and quite stable.

It has been the contention that the dredging of the Indiana portion of the river has caused sand choking and increased sedimentation upriver of the bedrock areas, particularly in the Momence Wetlands and in the recreational pool near the city of Kankakee. If sedimentation from Indiana has adversely affected the Illinois portion of the Kankakee River, there should be evidence

of island formation or sedimentary accretion on the downriver portion of islands and an increase in the widths of beaches and spits on the banks of the river over the period following the dredging activities. These data should be observable on time sequential aerial photos as well as on topographic maps of the Kankakee River in Illinois. Photographs and maps were procured for such an analysis.

Changes in the morphology of the Kankakee River between the Indiana state line and the city of Kankakee were evaluated by studying topographic maps surveyed in 1922, 1963-1964, and 1973 and high altitude, vertical air photos taken in 1939, 1954, 1961, and 1973.

The topographic maps surveyed in 1922 (1922 and 1924 editions) are 15-minute quadrangles named Kankakee and Momence. The 1963-1964 topographic maps are 7 1/2-minute quadrangles named Momence, St. Anne, Illiana Heights, and Kankakee. The 1973 maps are 7 1/2-minute photo revisions of the earlier 1963-1964 quadrangle maps. The earlier maps have a contour interval of 10 feet; the later maps are contoured at a 5-foot interval.

The 1939 (fig. 20), 1954 (fig. 21), 1961 (fig. 22) and 1973 (fig. 23) air photos are printed in this report at a scale of 1:20,000. The 1939 photos were taken on July 11 and July 31, the 1954 photos were taken on June 22, June 26, June 28, and July 12, and the 1961 air photos on May 22, August 13, and September 15. The 1973 photos were all taken on September 15. The 1973 photos were used at a scale of 1:42,000, but figure 23 has been enlarged to a scale of 1:20,000 so as to be compatible with the earlier photos.

AIR PHOTO EVIDENCE, 1939-1954

Increasing sedimentation in the Kankakee River resulting in accretion of beaches and islands is visible on air photos over the 1939 to 1954 period, particularly at the confluence of the Kankakee and Iroquois Rivers (figs. 20 and 21). Downriver of this confluence there is no evidence of sedimentation as the river bank remained intact.

The relatively quiet water at the mouth of the Iroquois River encourages backwater sand deposition from the Kankakee River. In addition, sediment entrapment and unloading, due to the angular configuration of the rivers, and a depression in the bedrock surface contribute to this river junction being a natural sediment accumulation area. The spit that protrudes from the north bank of the Kankakee River at the confluence point is a sensitive fluvial feature that increases or decreases in size in response to changes in the supply of sand. From 1939 to 1954 the length of the spit increased by about 330 feet. However, the extent of vegetative cover on the connecting portion of the feature on both the 1939 and 1954 photos suggests stability for considerable time prior to 1939.

Additional evidence indicating increased sedimentation during the 1939 to 1954 interval is the increase in length of an existing island and the formation of a secondary island in the Kankakee River midway between the Aroma Park highway bridge and the Kankakee-Iroquois River junction. From 1939 to 1954, the length of the island increased by about 300 feet due to sedimentation on both its upriver and downriver portions. Immediately south of the island, a second island emerged. This feature is about 800 feet long and 290 feet wide. Accretionary sand deposits are also visible approximately

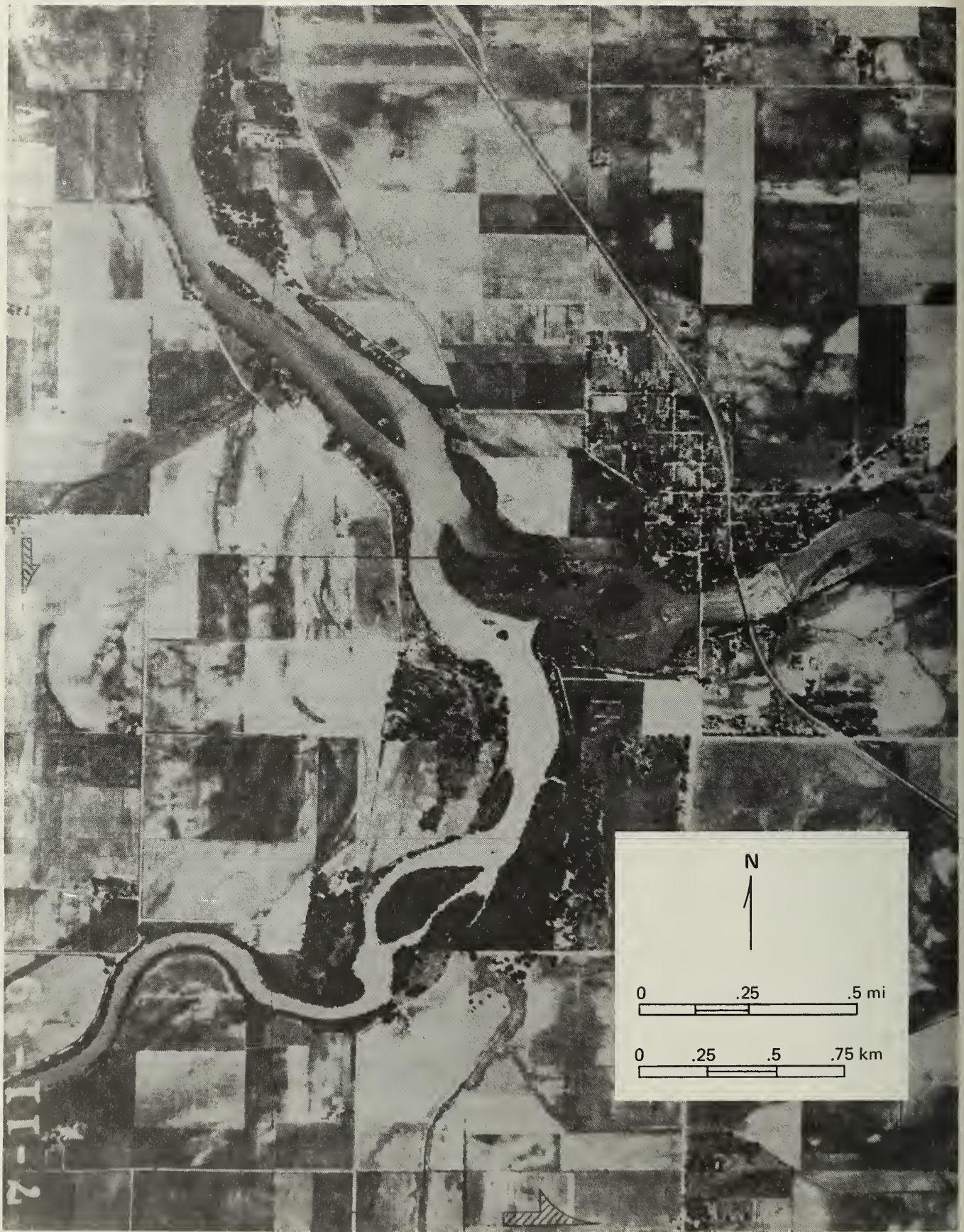


Figure 20. Aerial photograph taken July 11, 1939, of the junction of the Kankakee and Iroquois Rivers.

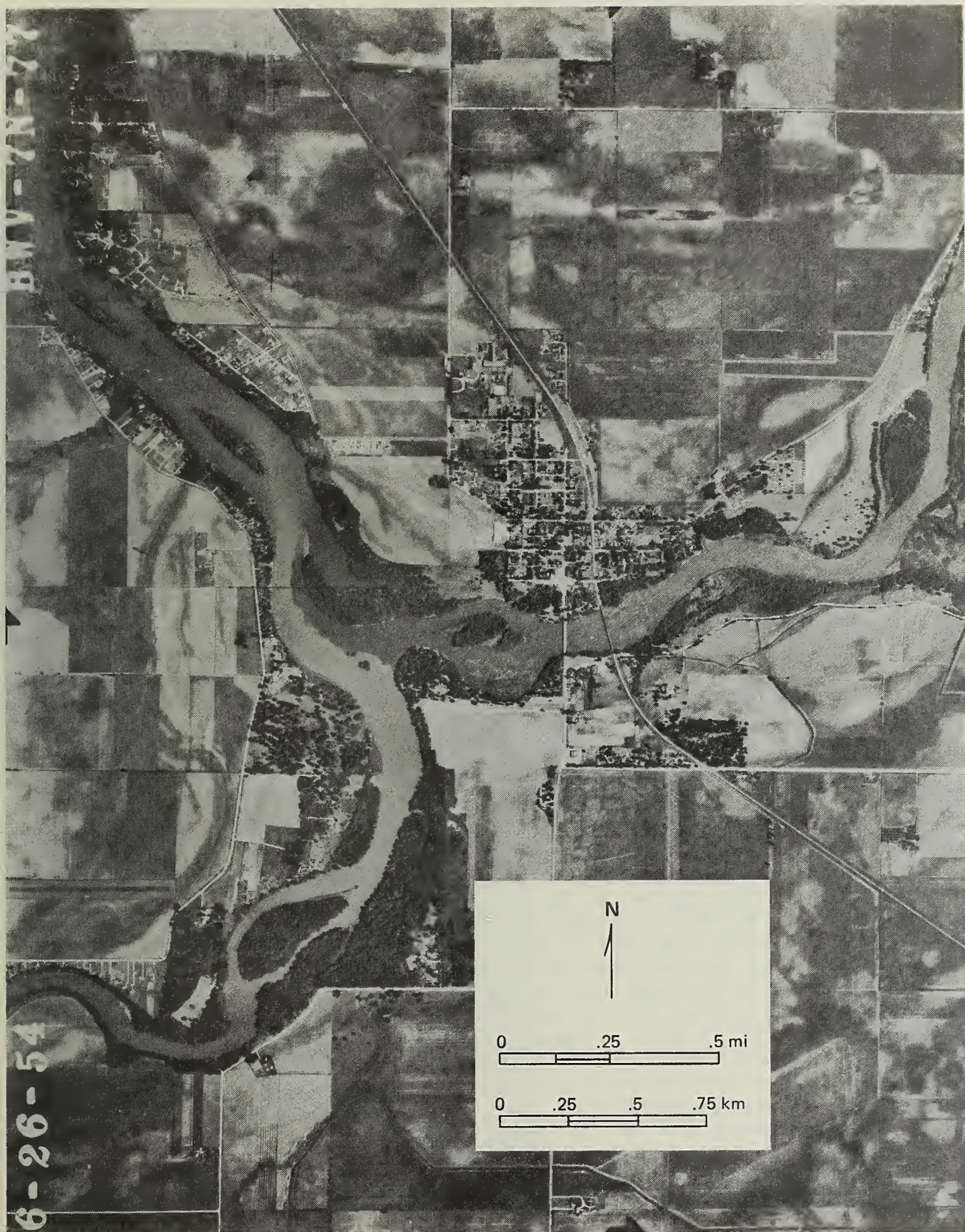


Figure 21. Aerial photograph taken June 26, 1954, of the junction of the Kankakee and Iroquois Rivers.

0.3 miles upriver in the Iroquois River, presumably due to backwater sedimentation from the Kankakee. Increasing sedimentation from 1939 to 1954 on the downriver portion of a large island resulted in a beach about 200 feet long between the island and a smaller island to the north. In addition, there was a noticeable increase in beach formation on the east bank of the Iroquois River adjacent to the island.

Further examination of accretionary fluvial features on the 1939 photo near the river junction (fig. 20) suggests that considerable sedimentation had occurred during the 20 years prior to 1939. This is indicated by the sparse vegetation on recently deposited sand about 0.6 mile upriver of the railroad bridge at Aroma Park on the north bank of the Kankakee and immediately upriver from the river junction on the west bank of the Iroquois.

No significant sedimentation appears to have occurred from 1939 to 1954 between Momence and the confluence of the Kankakee and Iroquois Rivers. Several relatively large sand deposits in midriver positions are visible on the 1939 photos, but not on the 1954 photos. It is believed that these deposits are localized. They do not appear related to differences in peak spring floods or to water elevation differences since river discharge was similar for these two years.

The absence of evidence of sedimentation along the meandering portion of the Kankakee River from near Momence to the Indiana state line, an area commonly thought of as having a surplus of sand, suggests that most of the sand is moving through this reach. Most appears to have been deposited either near the confluence of the Kankakee and Iroquois Rivers, or it flowed through the river system to the Illinois River.

AIR PHOTO EVIDENCE, 1954-1973

Additional analysis of air photos revealed that no significant changes in river morphology that were due to long-term sedimentation occurred during the subsequent 19-year period from 1954 to 1973 between the state line and Kankakee (figs. 21, 22, and 23). There is no evidence of island growth or increased beach formation caused by increased sedimentation near the confluence of the Kankakee and Iroquois Rivers. In fact, the islands downriver of the Aroma Park bridge, the spit just downriver of the confluence, and the island about 1 mile upriver in the Iroquois, all of which experienced accretion from 1939 to 1954, displayed an increase in vegetative cover and no added sand deposits from 1954 to 1973.

The spit at the confluence of the Kankakee and Iroquois Rivers extends about 165 feet farther downriver on the 1954 photo (fig. 21) than it does on the 1961 photo (fig. 22); in 1973 (fig. 23), the spit is about the same length that it was in 1954. Although the length of this feature in part reflects flood conditions, its inconsistent lengths through time suggest a general lack of sedimentation over the 1954 to 1973 period in an area favorable for sand accumulations.

Between Momence and the confluence of the Kankakee and Iroquois Rivers are a series of islands in the Kankakee, all of which are optimum locations for sediment accumulation. The only evidence for sedimentation within this reach occurs about .6 mile downriver of Eagle Island, where a sand bar between two islands is visible on a 1973 photo, but not on earlier 1954 and

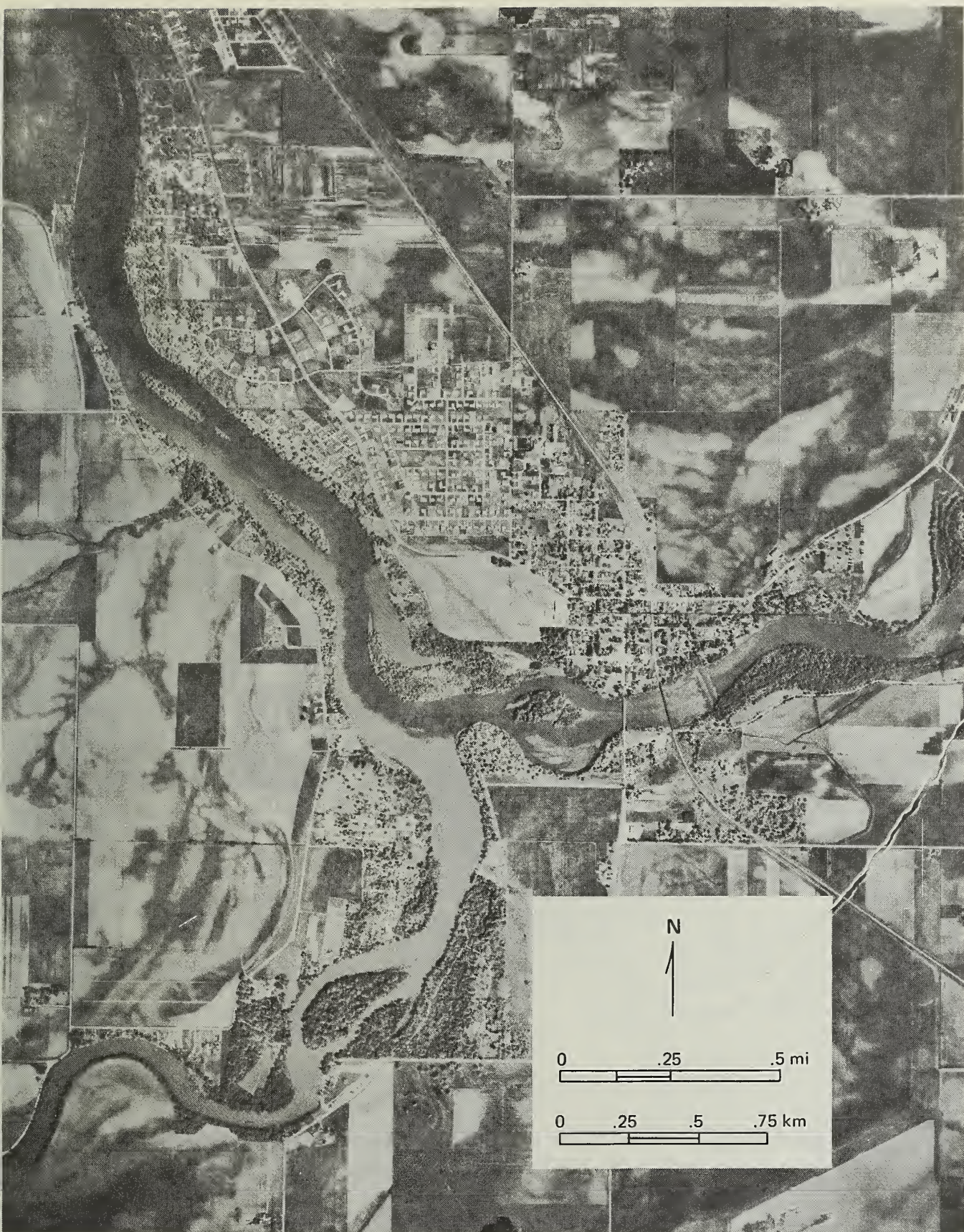


Figure 22. Aerial photograph taken May 22, 1961, of the junction of the Kankakee and Iroquois Rivers.

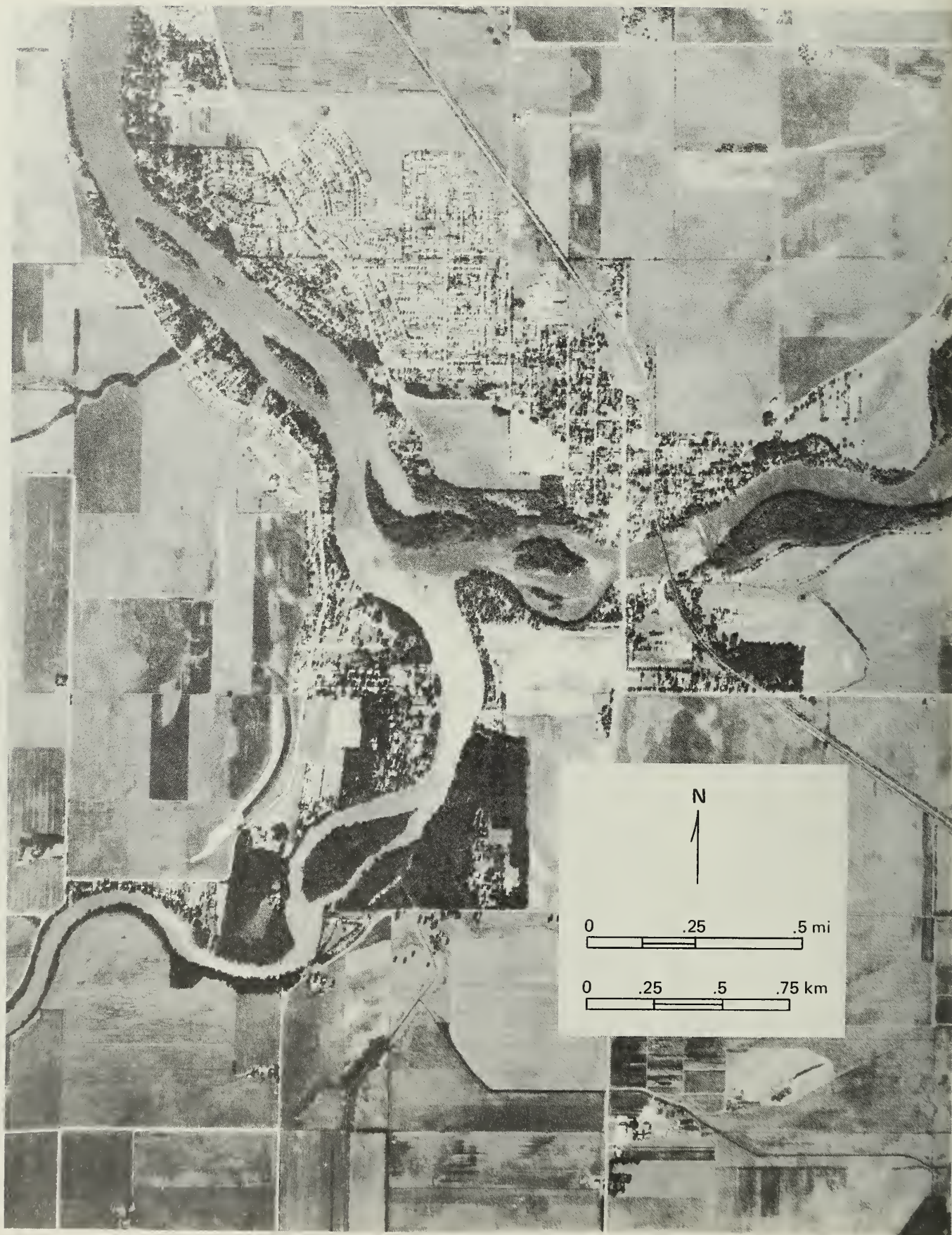


Figure 23. Aerial photograph taken September 15, 1973, of the junction of the Kankakee and Iroquois Rivers.

1961 photos. Besides this one location, all islands generally show increasing stabilization by vegetation, with no added sand deposits on their downriver portions between the years 1954 and 1973; this again suggests stability of the river system.

From Momence to the Indiana-Illinois state line, there is no evidence or surficial expression of sand accumulations that occurred between 1954 and 1973. The only major change in river morphology was the cutting off of a meander bend at the Chicago, Milwaukee, St. Paul and Pacific Railroad bridge, about .9 mile downriver of Litchfield between 1961 and 1973.

In summary, based on air photo evidence, it appears that sedimentation resulting in sand bars, spit extensions, and island and beach growth attained relative stability by the early 1950s. Although accretion was quite evident during the 1939 to 1954 period near the confluence of the Kankakee and Iroquois Rivers, it seems that most of the sand was deposited prior to 1939. The sparse vegetation on the sand suggests that the material was recently deposited, possibly coinciding with the completion of dredging operations in the Indiana portion of the Kankakee River about 1918.

The air photos show little evidence of sand accretion after 1954; this suggests that the river system is in a state of near equilibrium, at least temporarily. Even the higher peak discharges that occurred in 1973 and 1961, which should have encouraged additional amounts of sand to be transported and deposited in quieter water areas near the confluence of the Kankakee and Iroquois Rivers, apparently did not leave accretionary evidence. Increasing stabilization of accretionary sand deposits by vegetation from 1954 to 1973 attest to this near state of equilibrium.

TOPOGRAPHIC MAP EVIDENCE, 1922-1973

Evaluation of the 1922 topographic maps proved inadequate for study of possible changes in river morphology due to sedimentation. The lower standard of mapping on the maps made comparison to more recent maps virtually impossible because of the methods employed in locating river positions with respect to roads and other cultural landmarks. The 1963-1964 topographic map data and the 1973 photo-revised data, however, are useful. A lack of revisions on the later edition topographic maps, suggests that the morphology of the river remained virtually unchanged over this 10-year period. This evidence supports the earlier conclusions derived from studying air photos. The constant position of beach lines and spits and island shore lines, all extremely sensitive to river sedimentation processes, attests to the near stable condition of the Kankakee River.

SUMMARY

1. The Kankakee River in Kankakee County, Illinois, is a naturally meandering river flowing over a bed of sand and bedrock.
2. The Kankakee River in Indiana was channelized in the early years of the twentieth century and is today a man-made ditch of uniform cross section, extending straight for many miles between small bends.
3. Long-term management practices for the Kankakee River are currently the subject of litigation in Federal Court.
4. The surficial geology of the Kankakee River basin is well known, has been described in several published geologic maps, and is summarized in figure 3. Most of the landscape adjacent to the main stem of the Kankakee River in Indiana is sand. The geology of the Illinois portion of the basin is more complex including silty and clayey glacial tills, silty and clayey lacustrine sediments, exposed bedrock, and sand. The Iroquois River, a tributary to the Kankakee, drains an area of clayey glacial tills and fine-textured water laid sediments.
5. Drillers' logs, soil maps, geologic literature, topographic maps, and field observations were combined to produce a map (fig. 11) of the surficial geology of the areas adjacent to the Kankakee River in Kankakee County, Illinois.
6. Cores and grab samples of sediment from 186 locations were combined with probes of sediment thickness at 499 locations to produce a map (fig. 14) of the thickness of sand in the river in Kankakee County.
7. The geologic framework of the Kankakee River as we know it today was established at the time of the melting of the last continental glaciers. That melting occurred during the approximate interval from 16,000 to 13,000 years ago, the latter portion of the Woodfordian Substage of the Wisconsin Stage. The formation and migration of sand dunes continued after those dates and, in a few local areas, continues to this day. From the time of the glacial melting to the present day, the Kankakee River has carried great quantities of sand westward. The channelization increased the quantities of sand being transported.
8. The sediment occurring in the river today is mostly medium-grained sand. Locally, at the junction of the Iroquois and Kankakee Rivers and downstream in Six Mile Pool, there are small areas of silty, clayey sediment.
9. Throughout the length of the Kankakee, there is little variation in the grain size of the sand.
10. The chemical composition of the sediment in Six Mile Pool is similar to geologically old, baseline compositions reported for other rivers and lakes in Illinois. This is interpreted as an indication that the Kankakee is relatively unpolluted with respect to heavy metals.

11. From the Illinois-Indiana state line downstream to near the city of Momence, the river channel is underlain by thick deposits of sand overlying bedrock. In the several miles of river channel adjacent to Momence and a 2-mile reach of river upstream of Aroma Park, the Kankakee River is flowing over bedrock. In the area between the cities of Momence and Aroma Park, the channel contains a series of massive sand bars, up to 1 or 2 m thick, overlying bedrock. The upper (eastern) end of Six Mile Pool contains thick sand deposits. In the lower end (western) of Six Mile Pool, the main channel is underlain by bedrock although the insides of the meanders have sand bars.
12. The use of an informal phrase "the bedrock ledge at Momence" has lead to a serious misconception. Many of the residents of the basin have the incorrect impression that this "ledge" is a single obstruction, like a dam, in the river. It is in fact a 4-mile reach of the river where the water is flowing over natural bedrock.
13. The river is carrying great quantities of sand. In low-water stages, individual sand bars move downstream a significant fraction of a meter per day. In high-water stages, such as the major floods in the spring of 1979, individual sand bars are removed and the sediment is carried downstream; later in the season, new sand bars are deposited in the same or different locations.
14. The morphology (geometry of the main channel) of the channelized portion of the river in Indiana is amazingly stable. The channel has remained straight, there has been very little tendency to meander, and the banks are relatively free of serious erosion problems. This is atypical for channelized rivers in the Midwest.
15. The morphology of the meandering portions of the river in Kankakee County is relatively stable, although there are locally some areas of bank erosion and there have been local meander cutoffs in the Momence wetlands. Studies of aerial photographs indicate significant sedimentation occurring in the 1939-1954 interval, probably as a result of the upstream channelization. Relatively few changes have occurred between 1954 and the present.

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APPENDIX

Log of Test Hole KR-187

SE 1/4 SE 1/4 NE 1/4 Sec. 19, T. 31 N., R. 15 E., Illiana Heights 7 1/2-minute Quadrangle. Site at 627 ft elevation, on the east side of state line road at the timberline. Hole drilled by D. L. Gross, P. B. DuMontelle, R. C. Berg, and M. L. Sargent on November 27, 1979, using the ISGS hollowstem auger equipment.

Depth (ft)	Sampling Interval (ft)	Blow Count (no.)	Material
0-2			Modern soil developed in silty fine sand
2-14	6-7 1/2	3	Sand, yellowish-brown 10 YR 5/4, fine to medium, massive, trace silt, few pebbles up to 5 mm present below 11 ft depth
	7 1/2-9	4	
	10-11 1/2	3	
	12 1/2-14	4	
14-26	15-16 1/2	27	Sand, grayish-brown 2.5 Y 5/2, fine to medium, massive, trace silt, few pebbles up to 1 cm, same as above except that this material is unoxidized
	17 1/2-19	17	
	20-21 1/2	14	
	22 1/2-24	16	
	25-26 1/2	13	
26-30	27-28 1/2	38	Sand, as above, fine to coarse

Log of Test Hole KR-188

SE 1/4 SE 1/4 NW 1/4 Sec. 22, T. 31 N., R. 14 E., Illiana Heights 7 1/2-minute Quadrangle. Site at 622 ft elevation, on the west side of road, west of pond, 200 yards south of Kankakee River. Hole drilled by D. L. Gross, P. B. DuMontelle, R. C. Berg, and M. L. Sargent on November 27 and 28, 1979, using the ISGS hollowstem auger equipment.

Depth (ft)	Sampling interval (ft)	Blow count (no.)	Material
0-2			Modern soil developed in fine to medium sand, silty
2-16	10-11 1/2 15-16 1/2	12	Sand, yellowish-brown 10 YR 5/4, fine to medium, silty, massive, slightly coarser and less silty near base
16-30	20-21 25-26 1/2	46 55	Sand, grayish-brown 2.5 YR 5/2, fine to medium, trace coarse sand and few pebbles up to 5 mm
30-31	30-31	48	Till, gray 5 Y 5/1, silty, clayey, few small pebbles, calcareous, Yorkville Till Member of the Wedron Formation

Log of Test Hole KR-189

NW 1/4 NW 1/4 SW 1/4 Sec. 1, T. 31 N., R. 10 W., Illiana Heights 7 1/2-minute Quadrangle. Site at 631 ft elevation on south side natural levee or spoil bank of channel of Kankakee River, site 100 ft south of river and 100 ft east of road, in State of Indiana. Hole drilled by D. L. Gross, P. B. DuMontelle, R. C. Berg, and M. L. Sargent on November 28, 1979, using the ISGS hollowstem auger equipment.

Depth (ft)	Sampling interval (ft)	Blow count (no.)	Material
0-2			Modern soil developed in fine sand
2-11			Sand, light olive-brown 2.5 Y 5/6 interbedded with yellow-brown 10 YR 5/6, fine, trace of silt, becoming fine to medium near base
11-12 1/2			Sand, dark yellow-brown 10 YR 4/4, fine to medium with trace of silt, leaves and sticks mixed throughout
12 1/2-26	12 1/2-14	21	Sand, grayish-brown 2.5 Y 5/2, fine to coarse, few pebbles up to 5 mm
	15-16 1/2	19	
	20-21 1/2	33	
	25-26 1/2	14	
26-26 1/2			Silt, gray 5 Y 5/1, massive, compact, calcareous

Log of Test Hole KR-190

SW 1/4 SW 1/4 SE 1/4 Sec. 16, T. 31 N., R. 14 E., Illiana Heights 7 1/2-minute Quadrangle. Site at 620 ft elevation, 50 ft south of the Kankakee River, on the natural levee on the north side of the road. Hole drilled by D. L. Gross, P. B. DuMontelle, R. C. Berg, and M. L. Sargent on November 28, 1979, using the ISGS hollowstem auger equipment.

Depth (ft)	Sampling interval (ft)	Blow count (no.)	Material
0-3 1/2			Modern soil developed in silty fine sand
3 1/2-11	10-11 1/2	24	Sand, yellowish-brown 10 YR 5/6, fine to medium, massive, trace of silt
11-20	12 1/2-14	17	Sand, grayish-brown 2.5 Y 5/2, fine to medium, trace of silt, few pebbles up to 1 cm, slightly coarser downward
20-21	20-21 1/2	16	Till, gray 5 Y 5/1, silty, clayey, pebbles up to 1 cm, calcareous, Yorkville Till Member of Wedron Formation
21-21 1/2			Bedrock, dolomite

